

*A webcomic of romance, sarcasm,  
math, and language*

**xkcd**

**RANDALL MUNROE**

**2014**

**xkcd**

**2014**

a collection of 157 webcomics

from #1311 to #1467

*by Randall Munroe*

# #1311: 2014

## January 01, 2014

### NOTES FROM THE PAST

IT IS DESIRABLE EVERY THING PRINTED SHOULD BE PRESERVED, FOR WE CANNOT NOW TELL HOW USEFUL IT MAY BECOME.

CHARLES FREDERICK BRIDGES

1834

I PREDICT THAT A CENTURY HENCE THE CANADIAN PEOPLE WILL BE THE NOBLEST SPECIMENS OF HUMANITY ON THE FACE OF THE EARTH.

REV. JOHN STODOL

1863

IN THE TWENTY-FIRST CENTURY MANKIND WILL SUBSIST ENTIRELY UPON JELLIES.

THE BOSTON JOURNAL

1903

THE TWENTY-FIRST CENTURY BABY IS DESIGNED TO BE ROCKED AND COOLED BY ELECTRICITY, WARMED AND COOLED BY ELECTRICITY, PERHAPS FRIEDED AND MOTHERED BY ELECTRICITY. PROBABLY THE ONLY THING HE WILL BE LEFT TO DO UNDAID WILL BE TO MAKE LOVE.

POET JOHN LANE, THE CHRISTIANITY

1905

TO-DAY, IN THE CITY OF NEW YORK, SIXTY-SIX DIFFERENT TONGUES ARE SPOKEN. A CENTURY HENCE, THERE WILL PROBABLY BE ONLY ONE.

THE AMERICAN ASSOCIATION OF

1907

I OFTEN THINK WHAT INTERESTING HISTORY WE ARE MAKING FOR THE STUDENT OF THE TWENTY-FIRST CENTURY.

WILLIAM OWEN DOUGLAS

1908

CHINA MAY BE A GREAT SHOE MARKET A DECADE OR A CENTURY FROM NOW.

BOOTS AND SHOES PROBABLY

1914

WE CANNOT SETTLE THE PROBLEM, AND I VENTURE THE PROPHECY THAT PERHAPS A CENTURY FROM NOW THIS SAME QUESTION MAY BE BROUGHT BEFORE SOME FUTURE SOCIETY AND DISCUSSED VERY MUCH AS IT IS TONIGHT.

THE AMERICAN SOCIETY OF

1914

BY THE TWENTY-FIRST CENTURY I BELIEVE WE SHALL ALL BE TELEPATHS.

GLADSTONE, CHAIRMAN IN 1914

1923

THE PHYSICIAN OF THE TWENTY-FIRST CENTURY... MAY EVEN CRITICIZE THE LANGUAGE OF THE TIMES, AND MAY FIND THAT SOME OF OUR WORDS HAVE BECOME AS OFFENSIVE TO HIM AS THE TERM "LUNATIC" HAS BECOME OFFENSIVE TO US.

DR. C. FREDERICK BRIDGES

1924

HISTORIANS OF THE TWENTY-FIRST CENTURY WILL LOOK BACK WITH WELL-PLACED GORRN ON THE SHALLOW-MINDED DAYS OF THE EARLY TWENTIETH CENTURY WHEN FOOTBALL GAMES AND PETTING PARTIES WERE CONSIDERED THE MOST IMPORTANT ELEMENTS OF A COLLEGE EDUCATION.

MARY ELLEN FORD, LARRY

1926

IN THE YEAR A.D. 204 JOURNALISTS WILL BE WRITING ON THE CENTENARY OF THE GREAT WAR - THAT IS IF THERE HAS NOT BEEN A GREATER WAR.

EDWIN ARNOLD

1934

Some future reader, who may see the term, without knowing the history of it, may imagine that it had reference to some antiquated bridge of the immortal Poet, thrown across the silver Avon, to facilitate his

escape after some marauding excursion in a neighbouring park; and in some Gentleman's Magazine of the next century, it is not impossible, but that future antiquaries may occupy page after page in discussing so interesting a matter. We think it right, therefore, to put it on record in the Oriental Herald that the 'Shakesperian Rope Bridges' are of much less classic origin; that Mr Colin Shakespear, who, besides his dignity as Postmaster, now signs himself 'Superintendent General of Shakesperian Rope Bridges', is a person of much less genius than the Bard of Avon. --The Oriental Herald, 1825



## Explanation

This New Year comic is to commemorate the New Year by giving us a view of the coming year (2014) from the past. The comic includes many quotes from the 1800s and early 1900s that speak to a time close to 2014. Many of them are for the twenty-first century in general, and only three mention a year that would be 2014 exactly. All but one of them is a prediction, yet some of these are quotes from fictional literature, and therefore are not true predictions. Words are in boldface to highlight the relevant content in the quote. The grey or non-bold text is non-essential to the point Randall is interested in, and only to be used to understand the context of the quote.

The title text refers to a certain British officer, Mr. Colin Shakespeare, who experimented with and promoted the use of rope suspension bridges in India. The reference to "The Bard of Avon" is a reference to Shakespeare (the playwright), as Avon is the river on which Stratford upon Avon is set, and is where the playwright was born and spent his youth. The author of this quote under the guise of eliminating the potential confusion that might result after decades or centuries have washed away the context, ironically and possibly vindictively, makes a point to note that the bridge is not named after the playwright, but Mr. Colin Shakespeare, whom he considers considerably less intelligent. This topic was previously covered in 771: Period Speech.

Two years before, another New Years comic with just the

new years number as the title was released: 998: 2012. But actually the content of this comic is more related to the comic coming out just before the 2012 comic: 997: Wait Wait, which is also a New Year comic, that took a look at what could happen in 2012, just as this one does for 2014... In 2016 another comic, with only the new year as the name theme, occurred again 1624: 2016. For some reason this only seemed to happen in the even years, until 1779: 2017 was released, with 1935: 2018 being the next one.

The style of the comic is very similar to that of 1227: The Pace of Modern Life, which was released half a year earlier.

### **Additional information[edit]**

## #1312: Haskell

*January 03, 2014*



The problem with Haskell is that it's a language built on lazy evaluation and nobody's actually called for it.

## Explanation

The comic pokes fun at Haskell, a functional programming language. Functional programming languages are based on the mathematical concept of a function, that is two calls to a function always produce the same results given the same inputs. Side effects of a function call are changes to the program state or observable interactions with the outside world, other than returning a value. As a simple example, if a sum function changes a global variable, or prints the sum before returning it, those are side effects. Functions in most other languages frequently have side effects, typically making them hard to analyze. Functional programming languages seek to avoid side effects when possible. Pure functional programming languages like Haskell push this agenda by isolating the inevitable side-effects (input/output at least) through the type system (more specifically in monads for Haskell).

The first joke says that Haskell only has no side effects because no one ever uses Haskell programs. Even in a traditional procedural programming language like C, if the program does not run, it can't have side effects.

In Haskell, effects are first class values. This means that you can use effects just like any value, assign them to a variable, pass them around, or manipulate them to make new and different effects. Thus, there are technically no side effects, only primary effects.

The title text is a joke about Haskell's lazy evaluation. The basic concept is that a value is not computed until it is actually used. Thus, it is possible to have a name representing the entire infinite list of Fibonacci numbers. However, until a particular element of the list is accessed, no work is actually done. The joke plays on "called" (referring to calling a function) vs. "called for" (requesting). Thus, Haskell may have value, but no one has either invoked it to get that value or requested such a language. A simpler example may be:

The "or" function is defined as a normal function but can conclude instantly without computing the 10000th Fibonacci number (a daunting task) since this second parameter isn't necessary : "true or whatever" is always true.

In reality, Haskell is indeed actively used, though it is not one of the most popular languages. It is in particular used by some financial institutions, safety conscious start-ups and websites (there are several active web frameworks in Haskell) like Randall's own.

## #1313: Regex Golf

January 06, 2014



`/bu[rn]t[coy]e[mtg]a[j]isoln[h][ae]d[lev]sh[nd]i[po]lls/`  
matches the last names of elected US presidents but not their opponents.

## Explanation

The comic talks about regular expressions, which are a way to specify textual patterns. Given a regular expression, one can search for the pattern it specifies inside a text string. If the pattern is found, it's said that the pattern "matches" the string; if it's not found, it's said it doesn't match. The title of the comic and the first panel is based on "regex golf", which is a discipline of "code golf", a game in which programmers attempt to solve a given programming problem using as few characters as possible, analogous to the number of golf shots it takes to reach the goal. In regex golfing, the programmer is given two sets of text fragments, and tries to write the shortest possible regular expression which would match all elements of one set, while at the same time not matching any element from the other set. The day after this comic was released, Randall mentioned he got distracted by <https://regex.alf.nu>, a website with a regexp golf game, while researching for the what if? article T-rex Calories. Regular expressions have been mentioned on xkcd in many other comics.

In the regex golf challenge Megan faced, the two sets are the subtitles of the (then-extant) films from the Star Wars and Star Trek franchises. Her regex must match all Star Wars subtitles, and must not match any Star Trek subtitle. Subtitles are the secondary titles of the movies, after the "Star Trek: " or "Star Wars Episode N: ". For example, in Star Wars Episode I: The Phantom Menace, the subtitle is The Phantom Menace. In the first panel,

she has created a 12-character regex solving the challenge.

Then she moved on to building a tool which would automatically build such a regex for arbitrary lists of text, which could be described as meta- regex golfing. But as she has lost this tool, she needs to search through her files and chooses a tool called "grep" to find it. This tool uses regexes, implying that she needs a regular expression that would find any code that appears to be a regex golf generator, which leads to another "meta-" layer of abstraction. At the end, Megan notes this sequence of meta-meta-... might go to infinity and Cueball quips that she now has "infinite problems" as a result of her efforts; Megan retorts that she already had "infinite problems" because she's geeky enough to run meta-versions of programs on themselves, and stubborn enough to continue on until she fails, to the exclusion of all else. This also seems to be a reference to a famous quote by Jamie Zawinski (see also 1171: Perl Problems):

## **Regular expressions[edit]**

The first regex Megan uses is `/m | [tn]|b/`, said to match Star Wars subtitles but not Star Trek. The forward slashes `/` just mark the start and end of the regex. The `|` character means "or", so the regex matches any string that contains the patterns `"m "`, `" [tn]"` or `"b"` (including the spaces). The square brackets match one of the enclosed characters, meaning that `" [tn]"` matches either `" t"` or `" n"` (that is, a space followed by a letter `"t"` or `"n"`).

(Note that in this explanation, the regex has been written in lower case. In general, regular expressions are case-sensitive—that is,



they treat upper- and lower-case letters as different. Regexes can be set to ignore case, and given that Randall's comic lettering is in all-caps, we can assume that this is done here.)

The Star Wars subtitles match the parts of the regex in the following way:

- "The Phantom Menace" is matched by "m".
- "Attack of the Clones" is matched by "[tn]".
- "Revenge of the Sith" is matched by "[tn]".
- "A New Hope" is matched by "[tn]".
- "The Empire Strikes Back" is matched by "b".
- "Return of the Jedi" is matched by "[tn]".

On the other hand, no Star Trek subtitle contains an M followed by a space, a T or an N preceded by a space, or any B, so the regex does not match any of them. Note that in the first six ("Original series") films, all subtitles start with "The", but as the "T" is the first character, it is not preceded by a space. Here is the list that Megan probably used:

- Original series:

The Motion Picture

The Wrath of Khan

The Search For Spock

The Voyage Home

The Final Frontier

The Undiscovered Country

- The Next Generation:

Generations

First Contact

Insurrection

Nemesis

- Reboot series:

(No subtitle)

Into Darkness

The animated film Star Wars: The Clone Wars was released before this comic. If it were included, it would not be matched by Megan's regex. (" [tn]" does not match, for the same reason as for the Star Trek films: the T is the start of the subtitle, and is not preceded by a space.) None of the subtitles of Star Wars films released since this comic ("The Force Awakens", "The Last Jedi", and "The Rise of Skywalker") match this regex, either.

Star Trek Beyond, which was released after this comic, would incorrectly match the regex since it is the first Star Trek title to contain a "b". However, since Star Trek Into Darkness and Star Trek Beyond both lack a colon in their titles, it is debatable whether they can truly be considered to have subtitles.

In the last panel ("...and beyond"), Megan uses the regular expression `/ (meta-)* regex golf /` to describe her problem. `*` means "zero or more" of the preceding character/group (parentheses `()` group characters). So this regex matches "regex golf", "meta-regex golf", "meta-meta-regex golf", etc. In a way this is regex golf in

itself, matching all levels of meta-regex golf while not matching anything else.

In the title text, there is a long regex that is the solution of another regex golf challenge: matching the last names of all elected US presidents but not their opponents. Note that the list of opponents includes some people who were previously or later became presidents, or who share a last name with someone who was president, so taken literally this is impossible. To make this work, the list of opponents must exclude any names of presidents. The regular expression itself works in a very similar way to the Star Wars/Trek one, including several different patterns separated by |. Each elected president matches one pattern while each opponent matches none.

The regex does not match either of the presidents elected since the comic's release ("Trump" and "Biden"), and thus would need to be updated. The regex does match Hillary Clinton's last name, but because a person with the same last name (Bill Clinton) was president, this isn't a mistake. There was already a losing opponent called George Clinton who ran in 1792 and 1812.

Here is a list of elected presidents and the patterns they match:

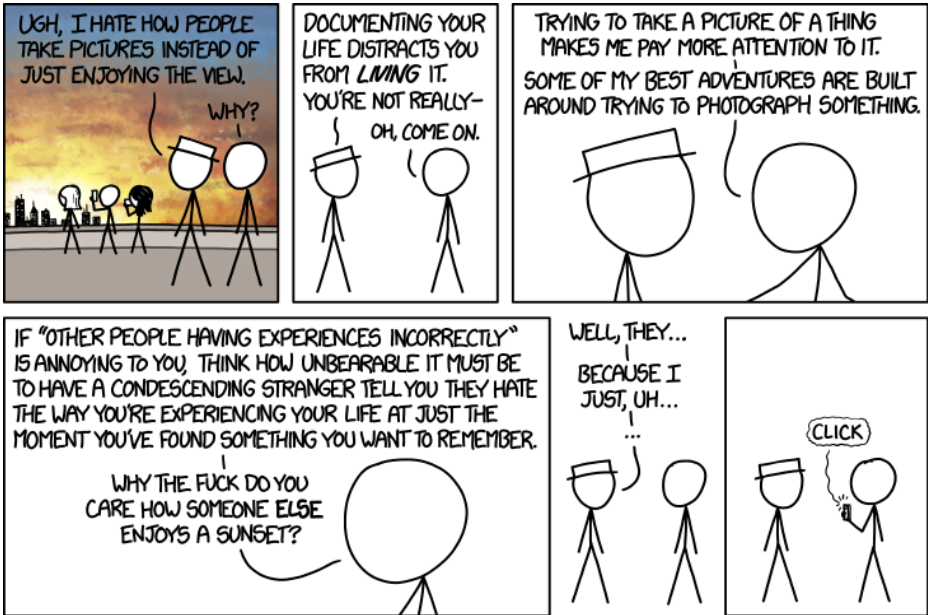
Four presidents (John Tyler, Millard Fillmore, Chester A. Arthur, and Gerald Ford) are omitted because they were never elected president. Each of them became president after the resignation or death of their predecessor. (Five other presidents—Coolidge, Truman, Theodore Roosevelt, and both Andrew and Lyndon B. Johnson—also succeeded to the office, but then went on to win a later presidential election.)

And here is a list of how many unique last names are matched by each expression:

Randall's regular expression does not match presidential opponents Pinckney, King, Clay, Cass, Scott, Douglas, McClellan, Seymour, Greeley, Tilden, Hancock, Blaine, Bryan, Parker, Hughes, Cox, Davis, Smith, Landon, Willkie, Dewey, Stevenson, Goldwater, Humphrey, McGovern, Mondale, Dukakis, Dole, Gore, Kerry, McCain, or Romney. However, it must be modified slightly, because it does match John C. Fremont, the runner-up to James Buchanan in 1856, as discussed by Peter Norvig at [xkcd 1313: Regex Golf](#). Note that Norvig provides a small amount of Python code which actually plays regex golf with arbitrary lists, and found a shorter solution than Randall's for the Star Wars vs Star Trek game (`/ t|p.*e/`).

## #1314: Photos

January 08, 2014



I hate when people take photos of their meal instead of eating it, because there's nothing I love more than the sound of other people chewing.

## Explanation

White Hat is upset at the sight of people photographing a richly colored sunset. His argument is that by documenting it instead of simply enjoying it, they have become an observer rather than a participant in life. Cueball expresses a contrary view, saying that not only does taking a photo of something help him focus attention on it, it is also none of White Hat's business how someone else chooses to enjoy a sunset.

Cueball's logic reduces White Hat to inarticulacy, then speechlessness. Cueball then takes a photograph, implying that he would most enjoy White Hat's discomfiture by recording an image of it for posterity.

Randall discusses a similar situation in the title text, the common modern phenomenon of restaurant diners photographing their meal. However, in this case he says he does not like them to document as he likes to listen to them eat. This may be sarcasm since not many people love the sound of someone else chewing.[citation needed] However, some people are annoyed by the food images posted to sites such as Facebook and Instagram. Note that the photograph is taken quickly; the chewing is only delayed for a few seconds. This brevity in delay can also apply to the main comic, since spending a few seconds photographing a sunset is just a brief interruption in enjoying the view sans camera.

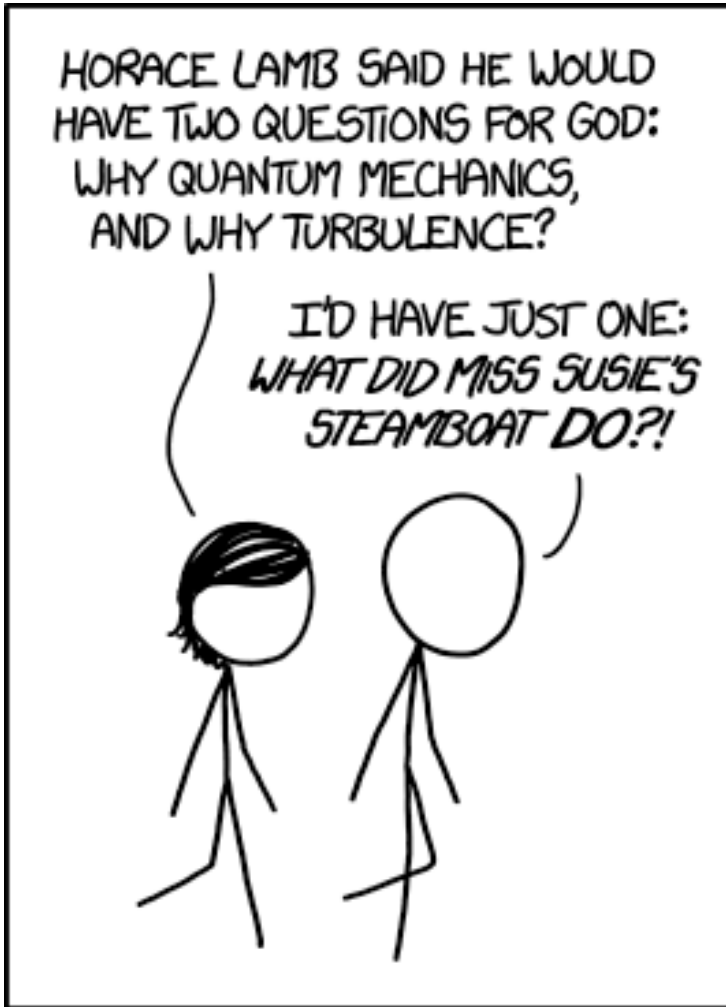
This comic is referenced in Thing Explainer in the

explanation Picture taker by a small drawing of people taking photos of the view from the edge of a cliff. Another Cueball standing behind those taking pictures (another than in this comic for sure) is talking to Megan:

See also 648: Fall Foliage about Megan taking pictures and Cueball complaining. Later in 1719: Superzoom White Hat and Cueball again discusses photography, while in 2111: Opportunity Rover White Hat shares this same opinion again.

## #1315: Questions for God

*January 10, 2014*



What sins could possibly darken the heart of a STEAMBOAT? I asked The Shadow, but he says he only covers men.



## Explanation

Megan is paraphrasing a famous quote from the British applied mathematician, and fellow of the Royal Society, Horace Lamb, who famously stated in 1932:

This was referring to two phenomena in physics that, at the time, were poorly understood and difficult to explain. Lamb proved to be correct in his prediction that quantum electrodynamics (QED) was easier to explain; nowadays we have a much clearer understanding of QED, while our understanding of turbulence has improved little. Richard Feynman, who was himself largely responsible for explaining QED, famously described turbulence as "the most important unsolved problem of classical physics".

Cueball, in response, indicates that if he were to gain divine elucidation his question would relate to the widespread schoolyard rhyme "Miss Susie", which typically begins with the stanza:

The rhyming scheme between the second and fourth lines, and implied contrast with "heaven," causes the listener to fill in the word "Hell" instead of the innocuous "Hello". Therefore, Cueball is wondering what a steamboat, an object lacking will,[citation needed] could have done to deserve divine punishment.

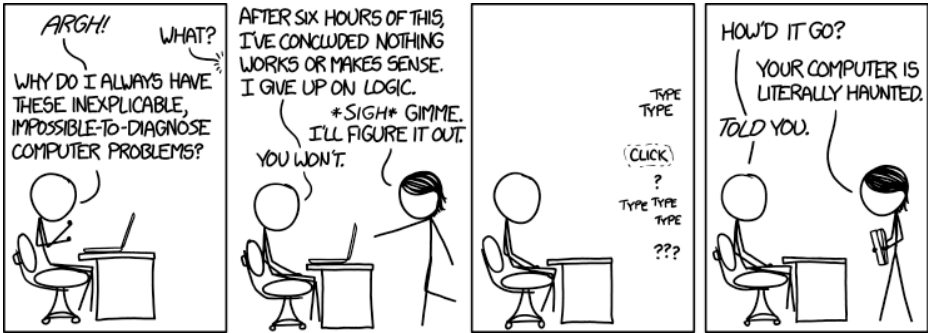
The title text is a reference to the 1930s pulp series "The Shadow", whose eponymous character is a psychic

vigilante. The 1937 radio plays introduction began with the line "Who knows what evil lurks in the hearts of men? The Shadow knows!" Unfortunately, since a steamboat is not a person,[citation needed] The Shadow would be unable to determine what heinous crimes the steamboat had committed to deserve damnation. Alternatively, this may be because boats are widely considered women.

This comic, in particular the way Megan and Cueball are walking and its reference to theology, greatly resembles the later comic 1505: Ontological Argument.

## #1316: Inexplicable

January 13, 2014



'It has a ghost in it. Take it back.' 'No.'

## Explanation

This is another comic in the "Cueball Computer Problems" series, in which Cueball's computer has resisted six hours of concentrated effort at resolution. Megan offers to help, but after trying to fix it, she concludes that the laptop is literally possessed by a malevolent spirit.

In the second panel, Cueball exclaims that he has "given up on logic." This could be a deliberate reference to the paranormal; ghosts are supernatural entities, and are thus immune to attempts at logical explanation.

The title text continues the conversation: when Megan tries to return the laptop to Cueball, he refuses, as Megan willingly took possession of it in the first place. Both have clearly decided that they no longer want anything to do with an object housing a supernatural entity, and are trying to pass it back to one another.

## #1317: Theft

January 15, 2014



THE THIEF WHO STOLE MY IDENTITY  
HAS A LOT TO DEAL WITH.

Is he **ALSO** wondering at what point our thoughts diverged, if they even have yet? 'dude, I think he just took your credit card' **AM I THE ORIGINAL? HOW DO I TELL?**

## Explanation

The term "identity theft" refers to a thief acquiring various types of a victim's identification (for example, bank account number and/or Social Security number), thus allowing the thief to pretend to be the victim and commonly steal money from the victim's bank account, etc.

This comic exaggerates the term, interpreting it as the thief literally acquiring the victim's whole personality. Like Cueball & Megan in general, the victim is implied to have some Randallian personality traits, like the love of space and existential angst. Thus, the thief is now completely overwhelmed by having an entirely new personality, not to mention one whose parts clash with each other.

The title text ponders the specifics of the identity acquisition process. Presumably, even two people whose personalities are identical would still start to think different thoughts. (This is a prerequisite for the depiction in the comic; the thief is baffled by his newly acquired interests, while the victim would not be baffled by the thoughts and interests they've developed over their entire life.) It is also wondered whether the victims new doppelganger is wondering the same thing, which could imply that their thoughts have not fully diverged. A friend comments that the victim may be overthinking the situation, and that the thief only took his credit card information. That is a common method of identity theft,

but one which does not transfer personality traits.[citation needed] However, the victim is overwhelmed by existential anxiety.

January 17, 2014

The image shows three identical circular diagrams arranged horizontally. Each diagram consists of a large central circle. Surrounding this central circle are eight smaller circles, each containing a stick figure. Each stick figure is holding a sign that says "ACTIVITY". The stick figures are positioned at the top, bottom, left, right, and four intermediate points (top-left, top-right, bottom-left, bottom-right). The text "ACTIVITY" is repeated around the perimeter of each diagram, following the curve of the outer edge. The diagrams are set against a white background.

27



## Explanation

The image shows a sphere, a simple model for the shape of the Earth. Six people stand on its surface, talking about ways to best describe it, starting with a flat surface, the first belief held, and ending with general relativity. As the statements form a circle, the very first statement can lead recursively off the last, as described below.

The statements in detail:

- This statement is located at the top of the sphere in the comic, making it most likely to be read first. Given no other context, it will be interpreted as referring to the Earth; i.e. "The Earth is flat." Early man, without any way to measure, likely assumed our planet's surface was flat.
- Many experiments over the ages have proven the planet to be round. These early scientists described their findings as the Earth being a "sphere."
- This clarifies the previous statement; an oblate spheroid has a wider radius at the equator than through the poles. This distinction would have been difficult to notice before the modern age with more precise instruments and the proliferation of airplane travel. On Earth, this occurs because a rotating body tends to bulge at the equator, where the matter experiences greater centrifugal forces (analogous to experiencing more force at the outside of a round-a-bout rather than at the center). This is known as the equatorial bulge.

- This adds even more clarification to the previous statement; the Earth Gravitational Model 1996 is a detailed map of the Earth's gravitational field, which is not as uniform as a pure oblate spheroid would suggest.
- This adds an almost unnecessary level of clarification to the previous; obviously the Earth's surface is not a smooth shape but rather contains numerous mountains, hills, valleys, etc. which constitute "local topography".
- This shifts the perspective from the actual shape of the Earth to the "shape" of the space around it. According to General relativity, our planet's gravity bends the space-time around it, making it curved. At the time General relativity was discovered, it was not conclusively known whether the whole universe was flat or curved.
- Looping around to the first statement and given the context from the previous one, this can now be interpreted as "the universe is flat" rather than "the Earth is flat". Recent measurements of the universe's shape strongly suggest that it is more or less completely flat rather than curved.
- This could also refer to Thomas Friedman's 2005 book "The World is Flat" which discusses globalization and the idea of the world as a level playing field of equal opportunity for commerce.
- The next two statements could also be interpreted as referring to the universe rather than the Earth - but they would no longer continue to be more precise than the

previous (Cueball's) statement.

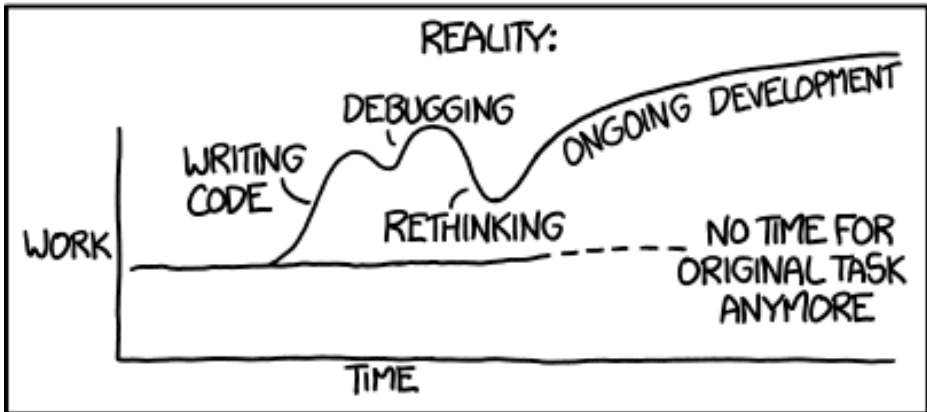
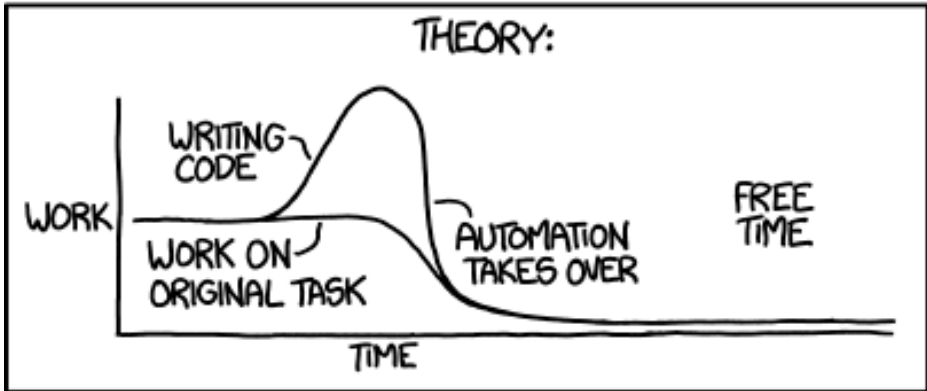
- The text will not continue on to form a recursive loop - as the statement about the EGM by Megan would no longer make sense in context of the universe - and the same would be true for the next two statements.

The title text pulls the whole comic together, pointing out that each statement in the comic is more precise than the previous. Unlike the loop in the comic, someone who does this will likely eventually win any real-life debate. The victory will not necessarily be a result of actually proving your logical argument, however: the phrase "stand alone" refers to driving away all conversation, resulting in no one wanting to speak to the person.

## #1319: Automation

January 20, 2014

"I SPEND A LOT OF TIME ON THIS TASK.  
I SHOULD WRITE A PROGRAM AUTOMATING IT!"



'Automating' comes from the roots 'auto-' meaning 'self-', and 'mating', meaning 'screwing'.

## Explanation

The comic refers to the phenomenon in which computer programmers attempt to create programs to automate menial but frequent tasks, to save time and effort. These attempts often end up taking much more time than the menial tasks would have taken. The first graph reflects the assumed ideal that leads programmers into such an attempt: writing the program will take more effort initially, but once the program is complete, it will take over the routine tasks, leaving the programmer free to do something else.

However, writing a program often turns out to be not that simple: programs can have defects, and certain functionalities can be hard to implement. Because of this, programmers usually spend more time than projected to finish a program. As time goes on, the desire to see it finished can consume the programmer's effort and attention, with the menial tasks left undone.

The title text is a play on the word "automating." While "auto-" is indeed a prefix that means "self," the root word "mat," from the Greek "matos," in fact refers to "moving" or "acting," so "automate" effectively means "self-moving." However, the title text uses a double entendre of the word "mating", the definitions of which include "to copulate," or, in slang, "to screw" (the latter having the double meaning of giving someone a hard time). This rendition of "automating" translates to self-screwing ("screwing yourself over", giving yourself a

hard time), which, according to this comic, happens when one attempts to automate a process.

See also 974: The General Problem and 1205: Is It Worth the Time? or the Time management category.

## #1320: Walmart

*January 22, 2014*

WHEN A NETWORK TRIES TO BE  
EVERYONE'S ONE-STOP HUB, THE  
WALMART OF SOCIAL INTERACTION...



... IT INEVITABLY BECOMES THE  
WALMART OF SOCIAL INTERACTION.

What I really want is to hang out where I hung out with my friends in college, but have all my older relatives there too.

## Explanation

This comic satirizes the way in which large social networks, such as Facebook (and at the time of this comic's posting Google+), attempt to aggregate all aspects of the user's online social presence. Earlier social networks had more granular focuses; e.g. MySpace originated with a music focus, and even earlier various bulletin board systems were centered around specific topics. By contrast, many social media companies attempt to encapsulate the variety of aspects of their users' online lives, thereby aggregating their personal, professional, and private lives in a way that was previously unlikely to occur.

The first comparison to Walmart, a large multi-national "big box" retailer that sells everything from gardening supplies to televisions to groceries, is apt because Walmart, too, is attempting to aggregate various aspects of your life into a single location - but rather than aggregating your social media presence, it's attempting to aggregate your shopping habits.

The punch line of the joke is that social interactions at Walmart are awkward, contrived, and frequently undesired — just as they can grow to become in a social network that is insufficiently focused or too bloated. People communicate differently with different groups of people, and if they are attempting to connect with friends, they are unlikely to want their grandparents present. Similarly, if a person is attempting to buy

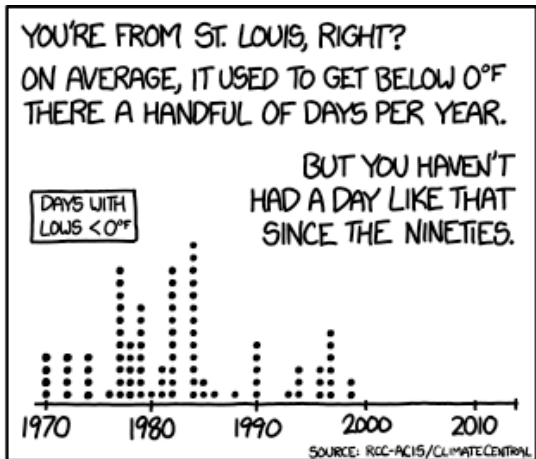


groceries, they may not be interested in extended small talk with acquaintances with whom they may not share much in common (perhaps the fact that they both shop at Walmart is the biggest similarity they share).

The title text elaborates on this idea by sarcastically implying that he wants all his older relatives to hang out where he hung out in college, likely causing extreme awkwardness.

## #1321: Cold

January 24, 2014



'You see the same pattern all over. Take Detroit--' 'Hold on. Why do you know all these statistics offhand?' 'Oh, um, no idea. I definitely spend my evenings hanging out with friends, and not curating a **REALLY NEAT** database of temperature statistics. Because, pshh, who would want to do that, right? Also, snowfall records.'

## Explanation

In this comic, Cueball (wearing a white knit cap with a pom-pom) and Cueball's friend (wearing a black knit cap) are walking outside in sub 0 °F (-17.8 °C). White Knit Cap Guy complains about the brutal cold and as a result questions whether global warming is real. Black Knit Cap Guy explains that this kind of weather used to happen all the time back before the year 2000, showing that global warming is, in fact, very real.

This is illustrated in panel two by a graph showing the number of days with sub 0 °F as a function of year from 1970 to 2013 in the city of St. Louis, (where we learn that Cueball is from). It shows that these days used to be rather common between 1970 and 1999, only to be completely absent for the next 14 years until and including 2013. A source link for this graph is provided (though as of June 2014, the link is dead - see Trivia below).

Cueball's friend uses this graph to explain that not a single day like this has happened since 2000, until here in 2014 where a polar vortex pushed the temperature down below zero again for two days. Since this weather is now unusual and infrequently experienced, people in St. Louis perceive it as being very cold because they have since adapted and are now unused to this sort of temperature, even though this was a common temperature to reach in past decades. This is further demonstrated when Cueball remarks that it's "too cold".

Subzero Fahrenheit temperatures are very cold to be out in. See for instance the first panel of 526: Converting to Metric.

In the last panel, in a future St. Louis, a Cueball discovers a thin sheet of ice, suggesting the temperature has fallen just below 32 °F (0 °C), the freezing point of water. The suggestion here is that the environment has warmed to such an extent that temperatures below 32 degrees F are very unusual, and the future Cueball repeats the same short-term fallacy that such "extreme cold" disproves global warming. Someone off-panel, presumably another Black Knit Cap Guy, sighs as the cycle continues.

The comic reacts to a simplified view of global warming by amateurs, including media, who fail to understand (or choose to ignore) the difference between climate and weather. Short, random weather fluctuations like the polar vortex are taken as examples or counter-examples of climate change and global warming. To understand climate change, one must look at global (not local) and long-term (not short-term) temperature trends.

Debates on the theory of global warming/climate change often center on whether the current warming trend is primarily caused by humans or is a natural change, as has happened in the past. Within the scientific community, there is an overwhelming consensus that the current trend is anthropogenic (i.e. man-made), but many in the general public (including many politicians) are hesitant to accept this. There is clearly no doubt about where Randall stands on this debate, as many of his comics and

blog posts continue to plead for humanity to do something about the man-made global warming trend - especially in comic 1379: 4.5 Degrees.

The title text suggests that gathering data about global warming is time-consuming and is the kind of stuff only a real nerd would do. Most people would rather hang out with friends, or at least spend their time with some more fun nerd activity. Randall has been known to use the title text to poke fun at himself over how much time he has spent researching topics and more generally how geeky his interests tend to be. Although the title text tries to deny this geeky behavior, he cannot help himself at the end by mentioning another interesting climate subject: Snowfall records.

Climate change, especially global warming, is a recurring theme in xkcd.

## #1322: Winter

January 27, 2014



Stay warm, little flappers, and find lots of plant eggs!

## Explanation

Beret Guy and Cueball are walking. Beret Guy is making several remarks about the situation. The air is cold, the puddles have frozen, he has mittens, the sunlight is warm, and the birds are chirping in the trees. When making these observations, however, he does not use the conventional terms. Instead he uses word compounds, similar to "Up Goer Five". This is pretty usual for Beret Guy's behavior, as he is often portrayed in many comics as having strange powers. When Cueball brings up Beret Guy's odd vocabulary, he retorts by declaring that the name does not matter, as long as the things themselves are what they should be. This is the same concept that is communicated in the line from the Shakespearean play, "Romeo and Juliet": "What's in a name? That which we call a rose by any other name would smell as sweet." The concept is similar to that discussed by Richard Feynman as the difference between knowing the name of something and knowing something.

In the title text Beret Guy continues to use playful language and offers affectionate encouragement: "stay warm, little flappers", demonstrating that his intentions are kind, not obfuscatory. Additionally, it is an indirect salutation from Randall Munroe to the readers, acknowledging the remarkably cold temperatures North America was experiencing at the time.

- The sky is cold: it's a clear, cold day

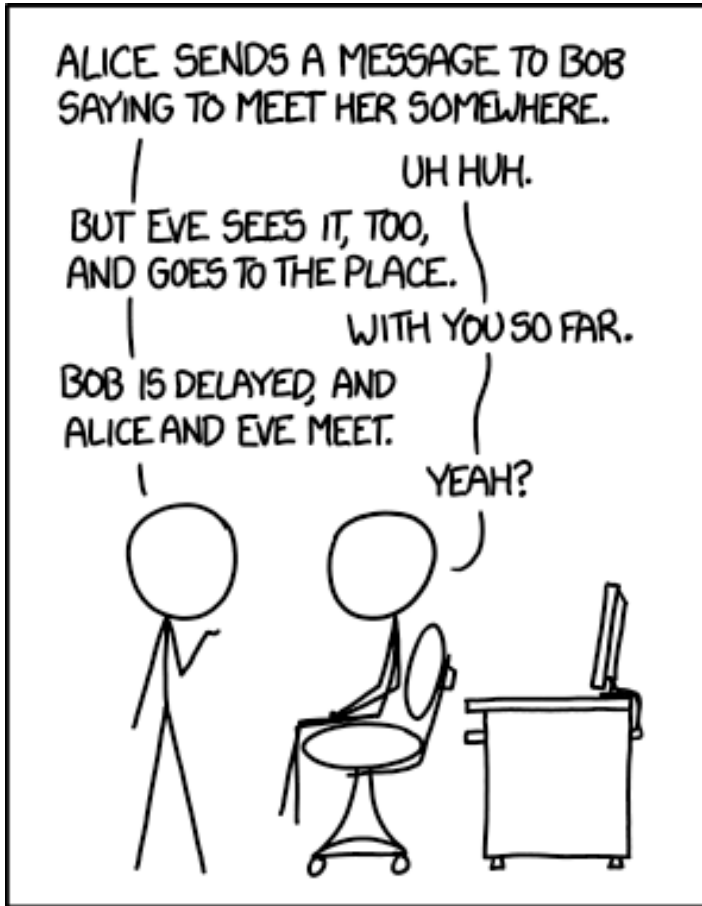
- floor water: puddle
- too hard to drink: frozen
- handcoats: mittens
- spacelight: sunshine
- flappy planes: birds
- beeping: chirping
- stick towers: trees
- little flappers: birds
- plant eggs: seeds, berries

Strange synonyms are also found in 919: Tween Bromance and 2352: Synonym Date. Beret Guy returns to describing seasons oddly in 2641: Mouse Turbines, but there his vocabulary is matched in oddity by what he's describing.



## #1323: Protocol

January 29, 2014



I'VE DISCOVERED A WAY TO GET COMPUTER SCIENTISTS TO LISTEN TO ANY BORING STORY.

Changing the names would be easier, but if you're not comfortable lying, try only making friends with people named Alice, Bob, Carol, etc.

## Explanation

Alice, Bob, and Eve are role names traditionally used in describing cryptographic protocols. Rather than talking about "Person A", "Person B", "Person C", names beginning with each letter are used instead, and giving them different genders let pronouns be used to shorten discussions. For example: "Person A sends Person B a message encoded with Person B's public key" is much easier to parse when written as "Alice sends Bob a message encoded with his public key." Eve is short for "eavesdropper" - a person trying to find out what's being said in the conversations between the other people. The classic situation involves Alice wanting to send a secret message to Bob, while Eve (the eavesdropper), attempts to read the message, ideally without Alice or Bob ever finding out. Additional participants such as Carol (Person C) can be added if necessary. The list of names has become very standardized over time as described at Alice and Bob.

The joke here is that any computer scientist, hearing the names used, will think that they are listening to a cryptography problem. By changing the names in a story to these role names, you can induce them to listen carefully to boring stories. The fewer the interesting details, the more it sounds like a general problem, so very boring stories are actually the easiest.

The title text shows a more radical approach to the problem, for people "who do not feel comfortable about

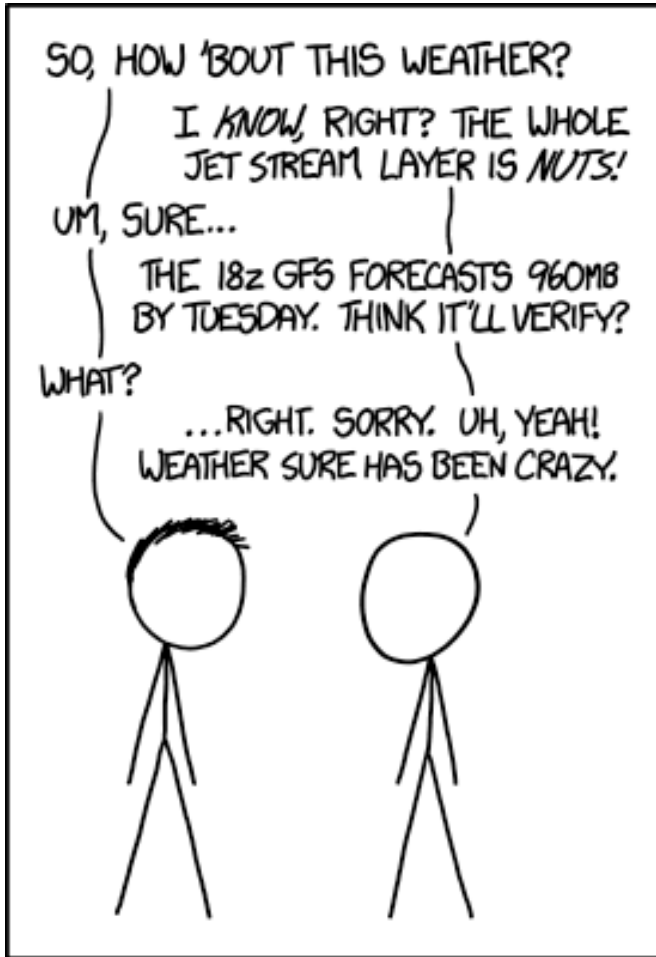
lying". In this approach, you only make friends with people who have the appropriate names already which means that technically you tell the story like it is. But this approach means investing a lot more effort into curating such a situation, possibly even to ensure that the Eve that you befriend is an actual habitual eavesdropper.

The comic title also can be interpreted in two ways. First, the computer scientist thinks the conversation is about an encryption protocol. Second, the way the conversation is carried resembles a protocol used by many data communication systems, where one side sends data while the other sends back an acknowledgement upon receiving the data. In this case, the data are the lines of the boring story.

In comic 177: Alice and Bob these names are used in the same context. Instead of Alice and Bob being perfectly innocent people who just want to communicate in private, Bob is actually having an affair with Alice. Eve—his former partner—cracked the encryption to see what the message contained. Thus, this comic seems to continue the Alice/Bob romance, jealous-Eve plot, with Eve apparently confronting Alice over her text message to Bob. The names are also mentioned in 2691: Encryption.

## #1324: Weather

January 31, 2014



WEATHER GEEKS HAVE IT TOUGH.

At least if you're really into, like, Turkish archaeology, store clerks aren't like 'hey, how 'bout those Derinkuyu underground cities!' when they're trying to be polite.

## Explanation

Social norm accepts casual small-talk as an ice breaker for interaction — usually it is always safe to talk about the weather without hitting any disagreements as there are rarely any personal viewpoints about the weather — in contrast small-talk is never about political subjects (except perhaps at a political rally or in a similar context where it is reasonably certain that everyone agrees) or similar where chances are that there are strong personal viewpoints.

In this strip Cueball is described a "weather geek", enjoying subjects such as meteorology and weather forecasting. When Hairy makes a comment about the weather, Cueball launches into a detailed technical discussion, not realizing Hairy is simply trying to engage in small-talk. Only weather geeks would have this problem, but this topic is a common opening for a conversation in casual small-talk. Cueball switches to small-talk once he realizes that Hairy is confused and didn't expect this level of technical information.

As to the jargon:

- Jet streams are strong air currents high in the atmosphere which have a big influence on the weather.
- 18z is 18:00 UTC (6 PM in London, 10 AM in California). See ISO 8601 at Wikipedia. The letter "Z" is used as 'Zulu' in the NATO phonetic alphabet, meaning just UTC.

- GFS is the Global Forecast System (also known as NCEP-GFS). It is a computer model used by the National Weather Service to predict the weather up to 16 days in advance. The model is run 4 times a day and the output is distinguished by the UTC hour it was started (18z in this case).
- Part of the prediction is the atmospheric pressure expressed in millibars (or mb). 960 mb is very low pressure, which is usually associated with seriously bad weather (for comparison, the record low pressure for Minnesota was 963 mb until 1998).
- "Think it'll verify?": A forecast "verifies" when an analysis of observations at the forecast time are found to match the forecast. Cueball is asking if Hairy thinks the prediction of a 960 mb low will be shown to have been correct.

The title text clarifies the problem weather nuts like Cueball here have: Unlike other geeky pursuits (like, say, the Derinkuyu Underground Cities, one of the most well-known archaeological sites in Turkey) weather is a fairly common small talk subject. As a result, weather geeks have to be constantly vigilant so as not to launch into technical monologues.

## #1325: Rejection

February 03, 2014



Perhaps you need a crash course in taking hints. Here's your first lesson: We're not actually walking somewhere together; I'm trying to leave this conversation and you're following me.

## Explanation

This strip portrays Cueball's (and likely Randall's) reaction to a very specific male complaint: that of self-proclaimed "nice guy" complaining about his lack of romantic success.

There's a stereotype, in popular culture, of women claiming they want to date nice guys, but actually dating men who are rude and/or treat them badly. This has given rise to a cliché about men who assume themselves to be nice guys, insisting that women reject them for being too nice. In reality, there are many reasons why a person might experience a lack of romantic success, but the notion that it happens as a result of being too nice is ridiculously simplistic and self-serving.

The Cueball-like guy on the left in this picture is complaining (presumably because he has been romantically rejected) that women, as a group, are either lying or self-deluded about what they really want. Cueball's sarcastic interjection is that this very response to the situation shows a) an inability to accept rejection and b) a disrespect for both the judgment and self-awareness of any woman who isn't interested in him. This behavior is passive-aggressive at minimum, and arguably both arrogant and misogynistic.

The thesis of the strip appears to be that the men who complain most loudly about being rejected for being 'too nice' are generally displaying that they're less nice than



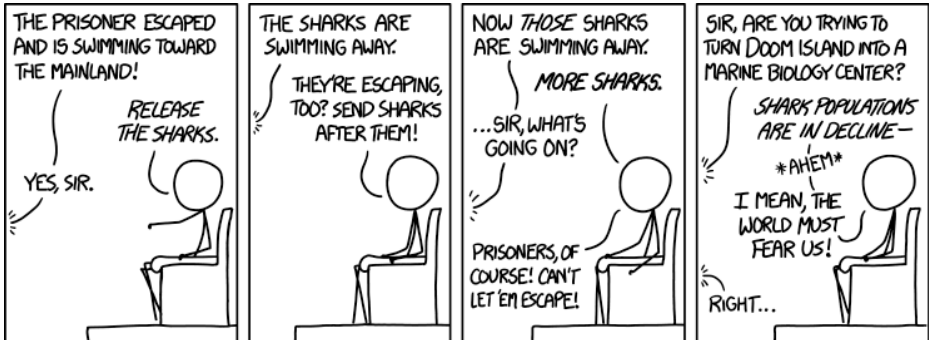
they imagine. While they may not be as overtly aggressive as other guys, responding to rejection by assuming there's something wrong with the person who rejected you (or with their entire gender, as in this case), is in fact both rude and condescending. The joke is that the guy is likely not nearly as nice as he imagines, and if being impolite were truly attractive to women, he'd be much more successful romantically.

The title text continues the "conversation", with Cueball implying that he believes that the first guy is bad at taking hints. He offers a "crash course" in hint taking by clarifying outright that he is trying to end the conversation while the first guy continues to follow him.

The concept of the self-identifying "nice guy" who actually may have less than admirable motives is also explored in 513: Friends. See also the concept of "negging" as used in 1027: Pickup Artist: you belittle chicks to undermine their self-confidence so they'll be more vulnerable and seek your approval.

## #1326: Sharks

February 05, 2014



'Now, minions, I'm off to inspect our shark cages.' 'Do you really need to inspect them this often?' 'PRISONERS MUST NEVER ESCAPE.'

## Explanation

This comic is a joke about the use of sharks in action movies. In these movies, sharks are often used to guard locations and dispense capital punishment. Since the idea of a guard shark is not practical, this comic suggests that villains raise sharks to help with declining shark populations in the oceans.

In this comic Cueball is an alleged evil villain who rules over a "Doom Island." In addition to commanding minions and detaining prisoners, he keeps sharks to threaten prisoners. When a prisoner escapes the island, he orders his minions to "release the sharks." However, the sharks do not hunt the prisoner, but merely swim away. The comic jokes that Cueball is using fugitives as a pretense to help with declining shark populations, and that Doom Island is just a front for a marine biology center. Cueball maintains the whole "guard sharks" idea as a cover-up, so that his minions do not catch on to the real mission.

The title text plays on the idea that Cueball can't be openly concerned with his sharks' welfare without his minions catching on. He claims to be inspecting the shark cages. As a shark cage is normally used to provide protection for divers wishing to observe sharks up-close, they would not work well as cages to hold prisoners (which is their stated purpose). The comic implies that when he is "inspecting the cages" he is really performing a scientific study on the sharks, or simply observing them

because he loves them.

Because a real villainous lair would have no use for shark cages, it follows that Cueball owns them solely for the purpose of gratifying his interest in his sharks, thus forcing him to keep up the pretense of the cages being of some help in preventing prisoners from escaping.

The shark issue is also one of the items on the chart of 1331: Frequency.

"Doom Island" is most likely meant to be a generic name for the villain's lair (a trope dating back to at least the first James Bond film, *Dr. No*); however, a real island of this name exists in Indonesia.

### **Use of sharks in movies[edit]**

In action movie trope from the '70s and '80s, evil villains use sharks to kill off enemies. Some examples are:

- *Le Magnifique*, with the opening scene of the French movie a spy is trapped in a phone booth, which is then lifted by an helicopter and lowered into the sea, where a squad of frogmen attach it to a shark's cage before opening the door.
- *The Phantom*, the Sengh Brotherhood has a Shark Pool in their Elaborate Underground Base. This is one of the parts of the film lifted directly from the very first *Phantom* story, published in 1936, so the trope is at least that old.
- *Despicable Me*, where the comical villain has a shark in his lair that unrealistically acts as a guard dog.
- *Austin Powers: International Man of Mystery*, Dr. Evil wanted

a pool full of sharks (with laser beams attached to their heads), but had to settle for ill-tempered mutated seabass.

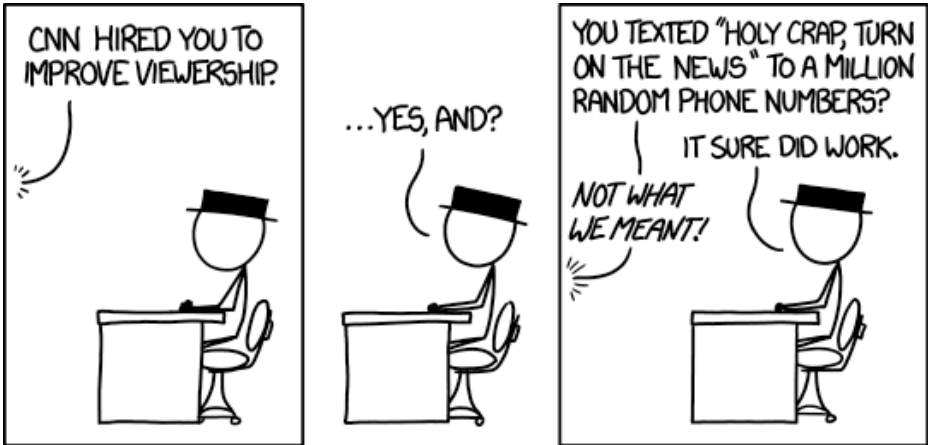
- Austin Powers: Goldmember, in which Dr.Evil actually does acquire his "sharks with frickin' laser beams attached to their heads"

And in the James Bond series:

- Thunderball
- Live and Let Die
- The Spy Who Loved Me
- Never Say Never Again with electronically controlled sharks in the Caribbean.
- Licence to Kill

## #1327: Mobile Marketing

February 07, 2014



We're firing you, but the online headline-writing division wants to hire you.

## Explanation

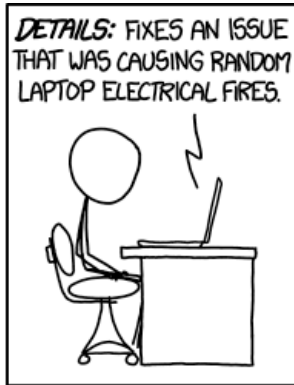
Black Hat was hired by the Cable News Network (CNN) to increase its popularity, presumably long-term. However, all he did was text one million people implying that a huge, unbelievable event was happening. While this technically did increase viewers of CNN, this was most likely only for a few minutes before the viewers realized nothing had happened. Because of this, Black Hat did very little to help CNN.

It is possible that this is the finale of a long career Black Hat has had in marketing, beginning in 125: Marketing Interview.

The title text is spoken by the offscreen character who, after saying that division of CNN was firing Black Hat, told him that the online headline writing department wanted to hire him. This is because the message Black Hat texted to the million phone numbers is very similar to click bait, which are headlines or titles that, like the text message, promise highly interesting articles without being very detailed as to their nature. Thus, perhaps online, Black Hat could bring clicks up long term through this unscrupulous practice, as opposed to mass unsolicited texts. The practice of link bait has also been mentioned in 1283: Headlines.

## #1328: Update

February 10, 2014



I have a bunch of things open right now.



## Explanation

When developers responsible for fixing errors on a specific operating system release a patch, the operating system often ask users to restart the computer after installing. This is often done by popup window shown to the user where they can choose to restart immediately or choose to be reminded later.

Many messages from these popups emphasize the importance of installing the updates, but Cueball is just annoyed about this. Sometimes, these issues are minor and do not affect most computers using the operating system. Often other programs, not part of the operating system, ask for a reboot because the updated routine only runs after the next reboot. Regardless, reboots can take a long time — a typical user doesn't like this. The user can choose to be reminded later multiple times. Because rebooting a computer takes a significant amount of time and closes any programs running, a user may delay the update repeatedly to avoid interrupting what they were doing at the time.

The comic is making two jokes simultaneously: the core comic jokes that reboots are so tedious and disruptive it would actually be preferable for a laptop to burst into flame than to go through one, while the title text suggests that the real problem is that humans are so incapable of delayed gratification and/or risk evaluation they would rather risk bodily harm than suffer a minor inconvenience.

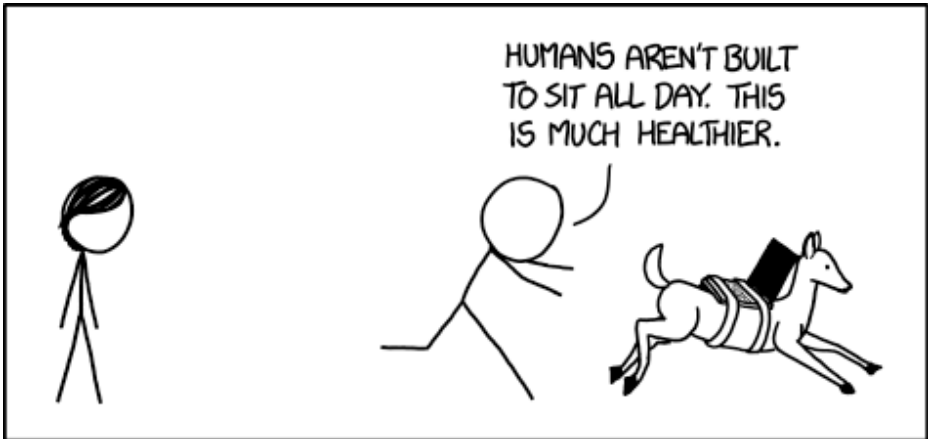
The joke uses an "exploding laptop battery" as an exaggeration for comedic effect. Most software doesn't affect hardware issues like burning

laptop batteries.[citation needed] However, low-level software, such as the kernel or drivers, might cause hardware to misbehave.

The title text reflects the fact that the average user will have multiple applications open and a reboot would require closing them. They would then have to open all their applications again after the computer has restarted. This can also refer to a browser application having multiple tabs open. This is becoming less of an issue because browsers have an option to restart the last session again after being closed, as would happen with a reboot, but many users still don't trust it to work properly.

## #1329: Standing

February 12, 2014



MY HOBBY: ONE-UPPING THE STANDING DESK PEOPLE

At first I was making fun of them, but joke's on me--the deer is surprisingly ergonomic, except for the kicks.

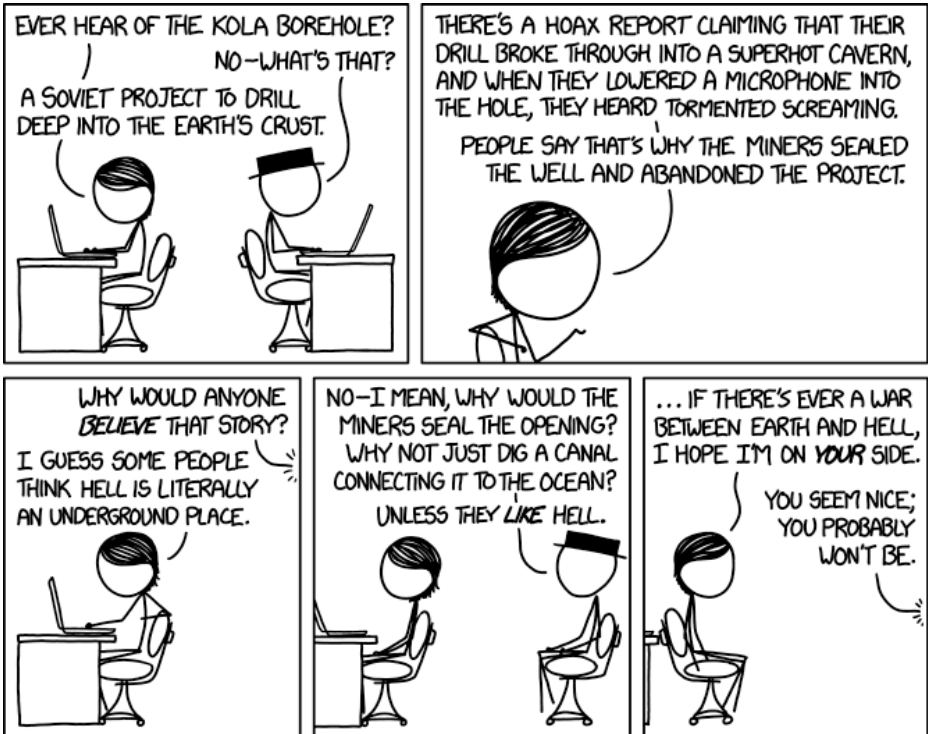
## Explanation

Standing desks are a current fad in modern tech companies. Supposedly more ergonomic and comfortable than sitting all day, they can be combined with treadmills or stationary bicycles to enable exercise to be taken while working. Cueball tells Megan that standing desks are inferior to his solution, strapping his laptop to a deer. The deer constantly runs away from Cueball, forcing him to chase and get exercise (and probably get kicked if he catches up). Additionally, by mentioning the common line of "humans weren't meant to sit all day", he is saying that his deer-based solution is much more similar to the task that humans evolved to do, namely hunting and gathering. Humans are in fact one of the few species built for persistence hunting, and are able to chase prey for more than four hours in ideal conditions. This is also why one's legs feel sore when standing for extended periods but not while moving.

The title text takes this a step further, saying that the deer was surprisingly ergonomic, apart from the kicks — which would, presumably, be quite debilitating. The ergonomics could be due to the soft, warm nature of the flesh compared to typical cold, hard tables.

## #1330: Kola Borehole

February 14, 2014



Tonight's top story: Lucifer, the Prince of Darkness, died in his home this morning at the age of [unintelligible rune]. Due to the large number of sharks inhabiting his former kingdom, no body could be recovered.

## Explanation

The Kola Superdeep Borehole is the result of a scientific drilling project by the Soviet Union in what is now north-western Russia that began in 1970 and continued through 1992. It was an attempt to drill as far into the Earth as possible. The deepest hole reached 12,262 metres (40,230 ft). It remains the deepest artificial point on earth.

Megan mentions the well to Hell hoax that the drilling hit a super-hot cavern which is disproved at [www.snopes.com](http://www.snopes.com): "The Well to Hell". Although super-hot temperature was the reason the project was abandoned, no chamber or voices were discovered. As Megan notes, the hoax plays on the popular notion that Hell is literally a physical place below us — therefore by definition, towards the centre of the Earth — whereas Heaven is above us; often depicted in the clouds.

Megan suggests that the miners therefore sealed the hole to "seal in" Hell. There is no mention in the Wikipedia article about the hole being sealed; however there is a picture with the caption "The borehole itself (welded shut)". If "sealing the hole" is considered to mean filling the entire hole up with concrete or some other material, then given the potential for future scientific data, the 22 years spent drilling and the cost of sealing the hole, this would not seem to be a reasonable thing to do.

Black Hat suggests that if the Hoax were true and the

miners did believe they'd drilled into Hell, a better alternative to sealing the hole would have been to dig a canal to the ocean, thereby allowing water to flow into the hole and into Hell. As all of Hell is depicted as below the surface of the Earth, and characterized by fire, brimstone, and extreme heat, this would entirely fill Hell with water, extinguishing the flames and cooling the trapped souls inside, as well as giving them a way out. (Depending on the volume of Hell, this could have significant effects on the global sea level and the atmosphere; see what if? article [Drain the Oceans](#).)

Megan never thought of that possibility and compliments Black Hat's ingenuity by suggesting that if there were ever a real conflict with Hell, she would want to be "on his side", given his clever suggestion on how to destroy Hell. He responds by suggesting that Megan is "nice" and therefore probably won't be on his side. This suggests Black Hat considers himself evil and thinks he would be fighting for Hell or maybe on behalf of those consigned there, rather than against it. Alternatively, he thinks he is worse than the devil and that Megan would be on the "nicer" side.

The title text parodies a nondescript news report of a person's death. In this case it is about Lucifer being killed by Black Hat carrying out his plan to flood Hell. However, the report is written in a non-descript way that ignores the presumed sensationalism of the story (i.e., that Hell exists and has been flooded). It is notable that "Lucifer" is often used in modern times to refer to Satan and both are used to refer to the "leader" or "keeper" of

Hell, although the Bible never directly identifies them as the same entity, and he/they are never tied directly to Hell anywhere in the Bible. Much of the modern image of Hell is derived from Dante's "Inferno" along with a variety of additional details which have been added and changed throughout the years. The reference to sharks is a reference to 1326: Sharks that was released a week before.



# #1331: Frequency

February 17, 2014

HEARTBEAT	ONE BIRTH	ONE DEATH	SOMEONE EDITS WIKIPEDIA	SOMEONE BUYS A VIBRATOR
CHINA BUILDS A CAR	JAPAN BUILDS A CAR	GERMANY BUILDS A CAR	THE US BUILDS A CAR	SOMEONE ELSE BUILDS A CAR
A EUROPEAN UNION RESIDENT HAS THEIR FIRST KISS	A US FIRE DEPARTMENT PUTS OUT A FIRE	SOMEONE HITS A HOLE-IN-ONE	MY TURN SIGNAL BLINKS	THE TURN SIGNAL OF THE CAR IN FRONT OF ME BLINKS
EARTHQUAKE (MAGNITUDE 1)	EARTHQUAKE (MAGNITUDE 2)	EARTHQUAKE (MAGNITUDE 3)	EARTHQUAKE (MAGNITUDE 4)	MEMBER OF THE UK PARLIAMENT FLUSHES A TOILET
AN AIRLINE FLIGHT TAKES OFF	SOMEONE BUYS TO KILL A MOCKINGBIRD	SOMEONE'S PET CAT KILLS A MOCKINGBIRD	SOMEONE IN PHOENIX BUYS NEW SHOES	SOMEONE IN PHOENIX PUTS ON A CONDOM
SOMEONE LOOKS THEIR KEYS IN THEIR CAR	A SAGITTARIUS NAMED AMELIA DRINKS A SODA	A DOG BITES SOMEONE IN THE US	SOMEONE STEALS A BICYCLE	A BALD EAGLE CATCHES A FISH
50,000 PLASTIC BOTTLES ARE PRODUCED	50,000 PLASTIC BOTTLES ARE RECYCLED	A BRIGHT METEOR IS VISIBLE SOMEWHERE	OLD FAITHFUL ERUPTS	A FISHING BOAT CATCHES A SHARK
SOMEONE IN THE US IS DIAGNOSED WITH CANCER	SOMEONE IN THE US DIES FROM CANCER	SOMEONE ADOPTS A DOG FROM A SHELTER	SOMEONE ADOPTS A CAT FROM A SHELTER	SOMEONE GETS MARRIED
SOMEONE REGISTERS A DOMAIN	SOMEONE IN THE US BUYS A HOUSE	SOMEONE IN THE US GETS A TATTOO	THE STAR PSR J1748-2446AD ROTATES 1,000 TIMES	SOMEONE LIES ABOUT THEIR AGE TO SIGN UP FOR FACEBOOK
SOMEONE BREAKS AN IPHONE SCREEN	A LITTLE LEAGUE PLAYER STRIKES OUT	SOMEONE HAS SEX IN NORTH DAKOTA	JUSTIN BIEBER GAINS A FOLLOWER ON TWITTER	SOMEONE IN DENVER ORDERS A PIZZA

This comic shows estimated average frequency. I wanted to include the pitch drop experiment, but it turns out the gif format has some issues with decade-long loops.

## Explanation

This comic shows a number of common events, arranged in a grid. Each of the events flashes with its average frequency.

For example, statistically a child is born somewhere on the world approximately every 0.24 seconds, or four times per second. Therefore, the tile "One birth" blinks about 4 times per second.

The title text refers to the Pitch drop experiment which measures the flow of a piece of pitch over many years. At room temperature, tar pitch flows at a very slow rate, taking several years to form a single drop. The title text jokes that Randall tried to include a tile that flashes about once every ten years, but the tiles are all animated GIFs and while the file format supports animations of any length, the resulting file would be too big (at least 10 megabytes).

A thorough analysis of the frequencies present in this comic and how they relate to the underlying technology (the GIF format) was published as Reverse Engineering xkcd's 'Frequency'.

The table below lists all the events and their periods/frequencies (computed from the GIF loop times). Some events make reference to other comics.

### Events[edit]

## #1332: Slippery Slope

February 19, 2014



Sure, taking a few seconds to be respectful toward someone about something they care about doesn't sound hard. But if you talk to hundreds of people every day and they all start expecting that same consideration, it could

potentially add up to **MINUTES** wasted. And for **WHAT?**

## Explanation

In the comic, White Hat uses a fallacious argument to Cueball to justify being inconsiderate to people. He argues that if he expends minor effort being considerate to one person, he will be expected to be considerate to everyone he meets, which - he wishes to argue - is an undesirable situation. Thus, he justifies being inconsiderate as a form of avoiding the "slippery slope".

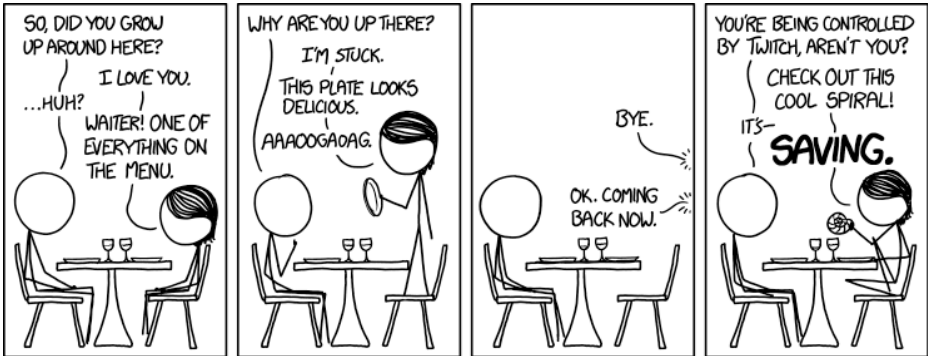
"Slippery slope" argumentation is an informal fallacy that takes the form of "if A happens, then B will follow as a minor but expected consequence. B will lead on to C, C leads onto D, and so on. Each consequence gets progressively worse until an undesirable situation is reached." A slippery slope argument proposes that A should not be allowed, because if it is, then the resulting chain of consequences will inevitably lead to the undesirable situation.

This idea is extended in the title text, where he continues extrapolating the train of thought to conclude that minutes of time would be "wasted". Rather than condemning the slippery slope fallacy per se, Randall's point here seems to be more that White Hat's priorities are callous to the point of sociopathy. All people desire to be treated with consideration and respect,[actual citation needed] and taking a few seconds to acknowledge another's feelings is (for most well-meaning people) a small price to pay for improving that person's day, or at least not making it any worse than it needs to be. As

such, these seconds would not be "wasted" at all, but would be actively making the world a friendlier place. White Hat's hyperfixation on not wasting time appears ludicrous given how much good feeling he could contribute to the world for so little of his own time. (White Hat also appears to be discounting the possibility that being considerate towards others will encourage reciprocity, which could result in SAVING him time since they will be more willing to help him out should he ever find himself in need.)

## #1333: First Date

February 21, 2014



I sympathize with the TPP protagonist because I, too, have progressed through a surprising number of stages of life despite spending entire days stuck against simple obstacles.

## Explanation

TPP, or Twitch Plays Pokémon, was the first of a creative and radical new variant of streaming gameplay videos created in early 2014 — a few days before this comic was released.

Some people enjoy watching video games being played by other people (usually 'popular' gamers known for entertaining gameplay), thus streaming sites dedicated to streaming gameplay were created. Twitch.tv was one such site.

Whereas traditional video game streams involved the channel broadcaster or another personality playing the game, the channel "Twitch Plays Pokémon" recorded a bot playing an emulated game of Pokémon Red for Game Boy. The game inputs given by the bot were based on players' messages in the video stream itself. Thus, the watchers of the stream were playing the game themselves using chat "commands." The Pokémon character behaved incredibly erratically, frequently getting "stuck against simple obstacles" (as mentioned in the title-text) and moving about in a strange manner ("Why are you up there?"/"Bye...Okay, coming back now").

Despite this, the character advanced surprisingly far in games. They have beaten the Elite Four and Champion of generations I, II, III, IV, and V, and VI. Twitch Plays Pokémon has also completed various ROM hacks and Spin-off titles, establishing a seasonal format with



multiple games each season. You can see the state of the player characters' Pokémon and inventory at game end in this Bulbapedia article.

TPP surged in popularity rapidly since its inception, reaching 80,000 channel viewers within five days. Derivative channels (such as 'TwitchPlayers') soon arose, turning "Twitch Plays..." into an idea rather than a single channel; that of crowdsourcing a task, such as controlling a single person (as in the Pokémon games) for erratic and often hilarious results. The stream, which is still active as of this writing, has reached memetic status.

In the above comic, Cueball and Megan are on a date. However, Megan is behaving very erratically. Cueball determines that Megan is being "controlled by Twitch," as her behavior matches well with that of the TPP protagonist (whose name, canonically, is Red).

Megan loudly declares at one point that she is "SAVING" her 'game progress', referencing the incessant saving in TPP via random button presses. The random ten-letter string she says is reminiscent of the nicknames that all of TPP's Pokémon end up with as the players move haphazardly across the game's keyboard.

Her fascination with the "cool spiral" is an allusion to TPP players' fascination with the Helix Fossil, an in-game item. As user input often leads to checking of the in-game backpack followed by erratic commands to handle the items within, it was common for various valuable items to be haphazardly thrown away. However,

as the Helix Fossil was a key item, it could not be tossed. It was also the first item in the Bag due to this, leading to the players' continuously selecting it whenever accessing their Bag, eventually causing them to somewhat jokingly regard it as an object of religious reverence. "Check out this cool..." is also a phrase used in various XKCD comics, such as 2703: Paper Title, typically in a tongue-in-cheek context.

The title text, as explained above, simply is a light-hearted joke from Randall, empathizing with TPP as he has also spent real-life days stuck against simple obstacles, and is surprised by how far he has gotten in life despite this fact.

#1334: Second

February 24, 2014



I HATE FEELING DESPERATE ENOUGH TO VISIT  
THE SECOND PAGE OF GOOGLE RESULTS.

Let me just scroll down and check behind that rock.  
Annnnd ... nope, page copyright year starts with '19'. Oh  
God, is this a WEBRING?

## Explanation

Google is a popular search engine.[citation needed] Google's searching algorithms are widely regarded as the most accurate and useful. If your search terms were sufficiently detailed, you will be able to find what you were looking for on the first page. Having to view the second page indicates your search terms were too vague or the answer to your query doesn't exist. When the search results typically number in the tens of millions (or more; in fact, more popular search results are in the billions), only the very first results are mapping to the real idea of the user. The second page is not helpful for the issue.

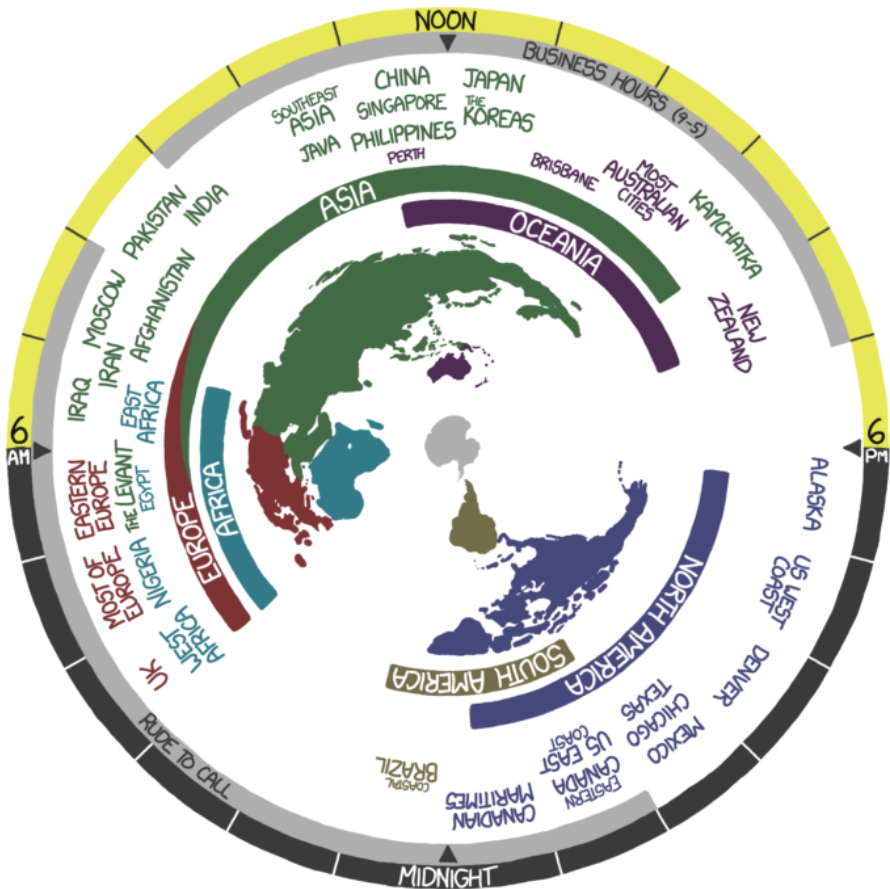
Cueball, after failing to find his query in the first page of results, takes a curious peek at the second page. This is represented by a not-at-all subtle metaphor in which Cueball is about to wander into a sun-baked desert. According to the title text, he finds one vaguely relevant webpage, but the copyright starting with '19', i.e from the 1990s or older, means that it's likely too old to be of any use.

The title text refers to webrings. Webrings consist of multiple websites that are connected together, usually with a common theme. They connect from one website to the next, eventually leading back to the starting site. They were popular in the 1990s as a way of boosting your search ranking, but newer algorithms in Google and other search engines are now detecting and penalizing

web sites for such tactics.[actual citation needed]  
Webrings were also used in pre-Google days to make it easy to find websites sharing a common theme, but since one site going down broke the ring, they were very inefficient. Seeing a webring typically means a site has not been updated since the mid 90s, though there are some people trying to bring them back for nostalgia reasons.

#1335: Now

February 26, 2014



This image stays roughly in sync with the day (assuming the Earth continues spinning). Shortcut: [xkcd.com/now](http://xkcd.com/now)

## Explanation

The picture is divided in 24 segments representing the 24 hours of the day. At noon and midnight, the break between segments is indicated by the tip of a dark grey triangle.

The picture rotates by 3.75 degrees every 15 minutes, as does the Earth so that it is constantly up to date in showing which regions are currently at which times of day. The picture change seems to happen halfway through a 15-minute time increment (that is, at  $7\frac{1}{2}$ ,  $22\frac{1}{2}$ ,  $37\frac{1}{2}$ , and  $52\frac{1}{2}$  minutes after each hour), so that the picture is always correct for the nearest multiple of 15 minutes.

The map projection of the earth in the middle of the picture shows an azimuthal equidistant projection with the South Pole in the center. This is unusual, as such projections typically put the North Pole in the center. But, in this case, may be necessary for the map rotation and the corresponding 24-hour clock graduations to both be the more conventional clockwise. Another reason might be just to depict all major land-masses (including complicated Antarctica, which is not otherwise referenced) in a non-discontinuous manner. Randall was playing on projections before in 977: Map Projections.

The list of cities and countries doesn't match the map exactly - notice how the continent of Australia is shifted

counterclockwise of the words "most Australian cities". This is because the map is centered relative to the time zones and the local variations. The map shows the configuration of time zones concerning daylight saving time (also known as summer time) at the time of the comic's initial release (February 2014); it was being observed in parts of Australia, New Zealand, Brazil, and other countries not named in this comic. If the map were to stay accurate through the year, the location of place names would have to move over the next few months as parts of the southern hemisphere went off DST and parts of the northern hemisphere went onto it; however, the map failed to change on the morning of March 9 as it should have (to recognize the start of DST in North America).

In many countries "business hours" are considered to be from 9 am to 5 pm. With some exceptions, including emergencies, it is generally considered rude to place a telephone call to someone's residence when most people are asleep; Randall portrays this period as extending from 10 pm to 8 am. This may be a reference to the 10 pm "cutoff" time discussed in an episode of "Curb Your Enthusiasm."

"Rude to Call" was also the name used by a G-mail experimental opt-in feature in 2009 which added a crossed-out phone symbol next to the sender if it was night in the sender's time zone when the reader loaded the email on their screen.

At midnight at UTC we can see this situation:

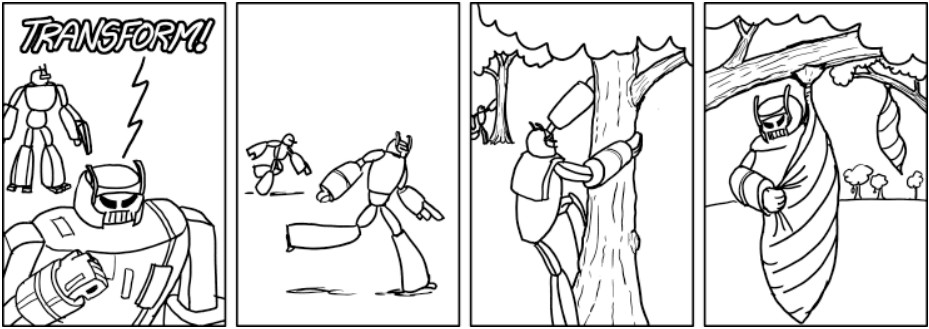


- 00:00 UTC Greenwich Mean Time
- 01:00 UTC Central European Time
- 02:00 UTC Eastern European Time
- 03:00 UTC UTC+03:00 (East Africa Time, Eastern Europe Forward Time, and Arabia Standard Time)
- 04:00 UTC UTC+04:00
- 05:00 UTC UTC+05:00
- 06:00 UTC UTC+06:00
- 07:00 UTC UTC+07:00
- 08:00 UTC UTC+08:00
- 09:00 UTC UTC+09:00
- 10:00 UTC UTC+10:00
- 11:00 UTC UTC+11:00
- 12:00 UTC UTC+12:00 or UTC−12:00
- 13:00 UTC UTC+13:00 or UTC−11:00
- 14:00 UTC UTC+14:00 or UTC−10:00
- 15:00 UTC UTC−09:00
- 16:00 UTC UTC−08:00 or Pacific Time Zone
- 17:00 UTC UTC−07:00 or Mountain Time Zone
- 18:00 UTC UTC−06:00 or Central Time Zone
- 19:00 UTC UTC−05:00 or Eastern Time Zone
- 20:00 UTC UTC−04:00 or Atlantic Time Zone
- 21:00 UTC UTC−03:00
- 22:00 UTC UTC−02:00

- 23:00 UTC UTC-01:00

## #1336: Transformers

*February 28, 2014*



A helicopter bursts from a chrysalis and alights on a rock, rotors still damp.

## Explanation

The comic is a parody of Transformers, a fictional group of robots that can transform into vehicles. Transformers typically are able to transform instantaneously, often mid-stride, by manipulating and rearranging their mechanical parts. In this comic, however, Randall has the Transformers "transform" in the same manner that caterpillars "transform" via metamorphosis into butterflies or moths.

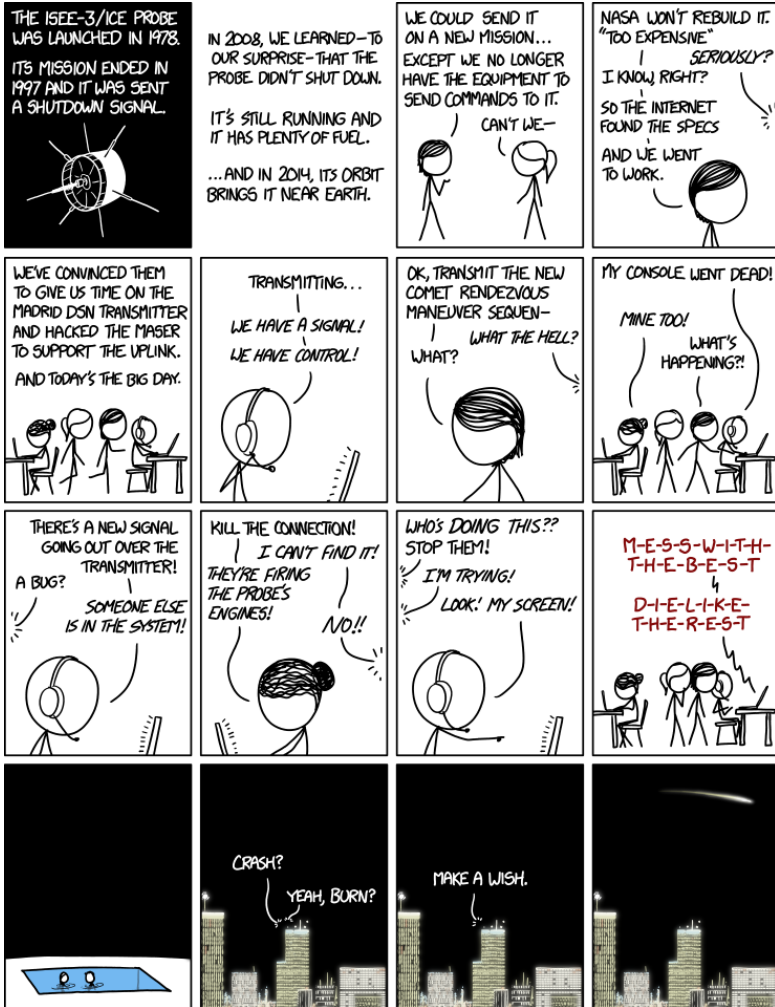
The first two panels show action scenes that would be appropriate for a Transformers comic. However, the third panel shows the Transformers climbing a tree, and in the final scene they wrap silk around themselves, apparently forming a cocoon or chrysalis.

The title text furthers this parallel, describing a newly transformed helicopter — presumably the post-metamorphosis state of one of the Transformers in the panels — in a manner that would be more appropriate for a freshly-emerged butterfly or moth.

This xkcd comic is one of the few ones not showing just simple stick figures.

# #1337: Hack

March 03, 2014



HACK THE STARS

## Explanation

This comic is an imagined project to re-position the ISEE-3/ICE probe, and a parody of the 1995 movie Hackers.

The history of the probe, as laid out in the comic, is true. The probe did, indeed, return to signal range in 2014, and seemed capable of being controlled, but NASA declined to devote the resources necessary to re-establish communication. The proposed, independent project to take control of the probe and send it on a new mission didn't exist at the time of the comic, but has since become reality, as Randall noted in a blog post. See details below.

The film Hackers was about the exploits of a group of teenage computer hackers, and their adventures in gaining unauthorized access to various systems. Like many fictional depictions of hacking, the film was heavily criticized for its lack of technical accuracy, but it did a lot to interest mainstream youth at the time in hacker culture. The primary protagonist goes by the handle "Crash Override", and his rival (and love interest) goes by "Acid Burn". The film ends with the two of them in a swimming pool, on their first date, with the lights in several nearby buildings spelling out "Crash And Burn", in Crash's latest hack/romantic gesture.

The strip depicts a scene in the satellite's control room, which plays out like many of the hacking scenes in the

movie, with the system operators being shocked and flummoxed at being locked out of their own system, while an unauthorized party takes control and sends alternative instructions. The screen displays the phrase "mess with the best, die like the rest", which was Crash's signature phrase in the film.

The final row depicts a recreation of (or sequel to) the final scene of the film, with Crash and Burn once again swimming together. This time, however, Burn tells Crash to "make a wish", immediately before a shooting star appears in the sky (there's a tradition of making wishes when shooting stars appear in the sky). The implication is that Burn is the one who hacked the satellite controls and that she placed the satellite on a course for earth, causing it to burn up in the atmosphere in exactly the right time and place to create her own shooting star. This is arguably a much more impressive feat than controlling building lights, and definitely one-ups his previous romantic gesture. Since the ability to do something so dramatic by hacking computer systems depended on a very specific and rare set of circumstances, it's unlikely that he'll ever be able to top it.

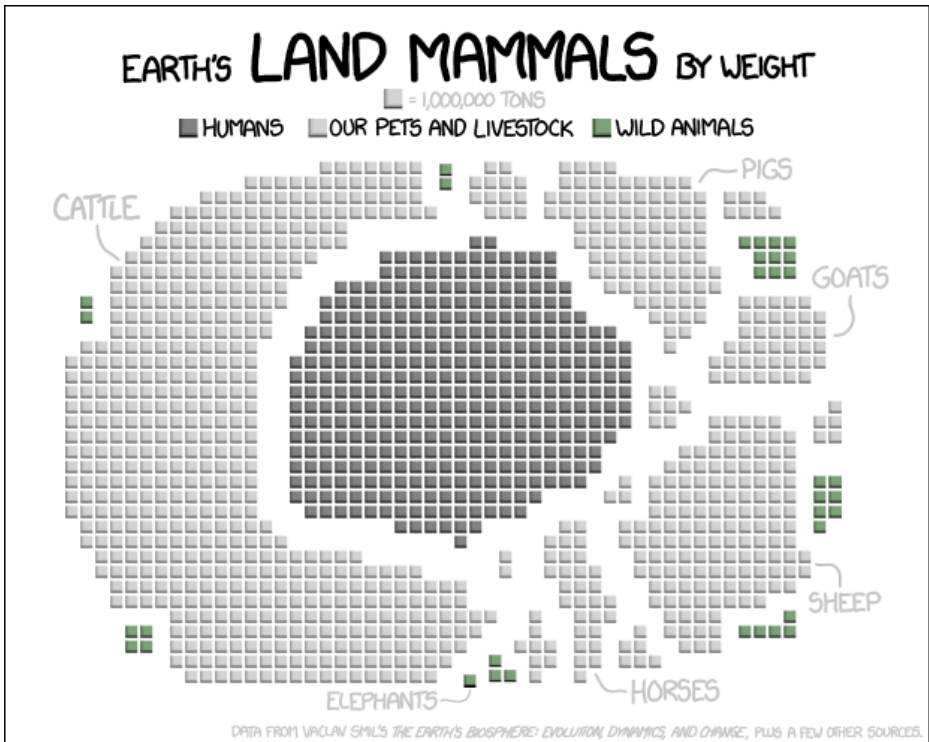
The comic number is 1337, which stands for "leet", short for "elite hacker" and "leetspeak" in leetspeak. Leetspeak is a form of symbolic writing that substitutes various numbers and ASCII symbols for letters. It originates from the hacker subculture, where words were converted to leetspeak e.g., to avoid filters and triggers on chat rooms. "1337" for "leet" can most likely be explained as calculator spelling.

The title text "Hack the stars" is also an allusion to Hackers, where the phrase "Hack the planet!" is used on multiple occasions. The movie was previously referenced in 689: FIRST Design and 1247: The Mother of All Suspicious Files.



## #1338: Land Mammals

March 05, 2014



Bacteria still outweigh us thousands to one--and that's not even counting the several pounds of them in your body.

## Explanation

This comic shows the total weight of mankind and all other land mammals. Only a few centuries ago, humans, their pets and livestock came to make up a great proportion of the earth's land mammal biomass. Note that only land-dwelling mammals are taken into account, so for instance whales and sea cows will not be included. (Whether this only covers animals that cannot live on land or any marine mammals like for instance seals and walrus, is not clear).

The design of the blocks loosely resembles a cell. This could be a reference to how these animals support humans, analogous to a cell supporting a central nucleus. If so, it seems that all the animals in this diagram, wild or domestic, in some way support human activity.

The title text states that bacteria outweigh us thousands to one, without counting the several pounds of bacteria in our body that are considered part of our own weight (like Gut flora). The aforementioned cell could also be a bacterium, making it a possible reference to the title text, since 1256 blocks have been used to sketch the "cell", and bacteria outweigh us by about this factor.

This comic may be a nerd snipe from Randall, challenging his readers to figure out the missing parts.

Randall also discusses animal biomass in *Fairy Demographics* in which he compares the biomass of

"fairies" to humans, horses, and humpback whales.

## **Weight[edit]**

According to the diagram, there are 358 million tons of humans, 864 million tons of pets and livestock, of which 520 million tons comes from cattle, and 34 million tons of wild animals; for a total of 1.256 billion tons.

The number of blocks represents the weight of the group in millions of tons = billions of kg. Note that some entries have the same number of blocks, and thus have the same rank.

Cattle, in aggregate, are much heavier than the human population. Humans outweigh both sheep and pigs put together. This may be a surprise for people in the countries that produce the majority of meat from such animals, because here these animals outweigh the population. But there are many parts of the world where especially pigs are not eaten, and it is not every where that sheep is in great demand. And especially in the some of the most populations dense regions in the Third World meat is not something you can afford to eat on a regular basis.

There are 13 distinct blocks of pets and live stock; only the top 5 are labeled - in order of weight they are: Cattle, Sheep, Pigs, Goats and Horses. Cattle, in aggregate, are much heavier than the human population, which has been inserted in the table for comparison:

There are 8 distinct blocks of wild animal (elephants and 7 others). The elephant is the only type of wild animal to be singled out in the comic. This may possibly be due to elephants being the largest land mammal. And yes, the world's heaviest land animal

only takes up one square. Also interesting is that the largest group of wild animals only comes in on the 8th place in the ranking (which is shared between the two tables).

The comic references the book *The Earth's Biosphere: Evolution, Dynamics, and Change* by Vaclav Smil as the source for most of the data. A few other sources have also been used, but were not referenced.

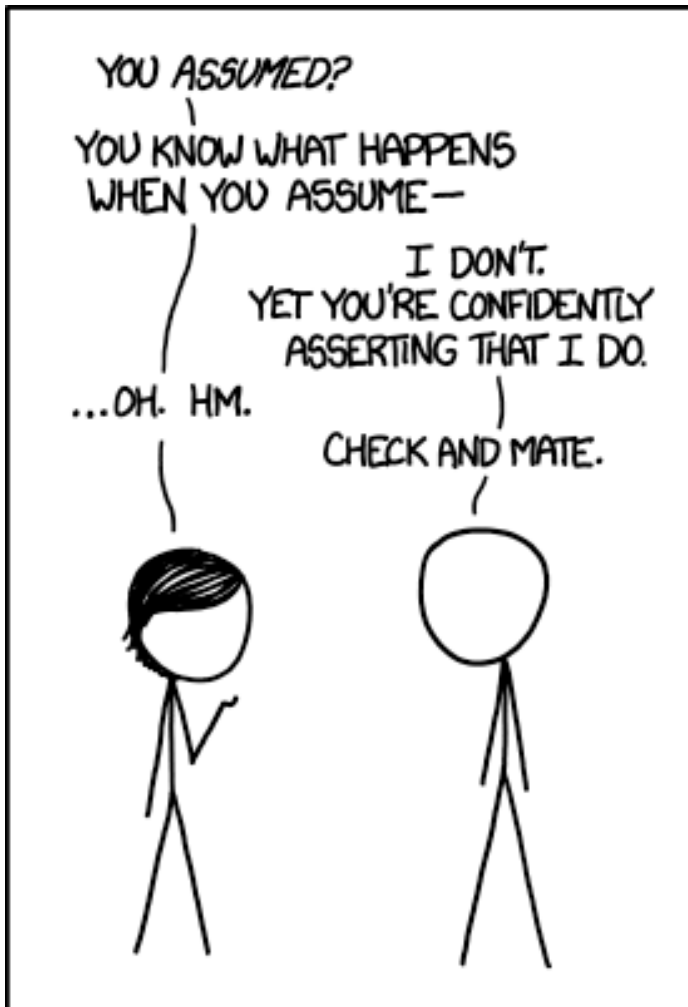
On page 186 of Smil's book, there is a bar chart with the following values:

Note that all labelled non-human animals are in this table. It seems that this table was the source of most of the data in the comic. Only land dwelling mammals are taken into account. Whales, wild vertebrates, and domesticated vertebrates are not included in the comic.

These are guesses about the identity of the unlabeled animals

## #1339: When You Assume

March 07, 2014



You know what happens when you assert--you make an ass out of the emergency response team.

## Explanation

Prior to the events in this comic, Cueball has evidently told Megan that he made an assumption about something. Megan starts to respond with a takeoff on the modern proverb: "When you assume, you make an ass out of you and me." This proverb plays on the fact that the word "assume" may be broken down into the letters "ass", "u", and "me", and is intended to suggest that one should not make assumptions because they may turn out to be wrong and make those involved appear foolish.

However, when Megan evokes the proverb in the modified form "You know what happens when you assume", Cueball astutely points out that her phrasing itself is hypocritical in that it makes the assumption that he knows what happens when you assume. Megan stops to ponder Cueball's point, to which Cueball responds "Check and Mate": a common phrase originating from chess — suggesting triumph or having successfully countered another person's argument to which there can be no retort. However, this would not make sense unless Cueball knows that assuming is bad, and he states in the comic that he does not know what happens when someone assumes. While Megan's tone of voice implies that when someone assumes, something bad happens, she does not state this explicitly, so Cueball would have had to assume that Megan was referring to something bad. However, Megan does not point this out, likely because she is too distracted by her own shame to notice that Cueball was also making an assumption.

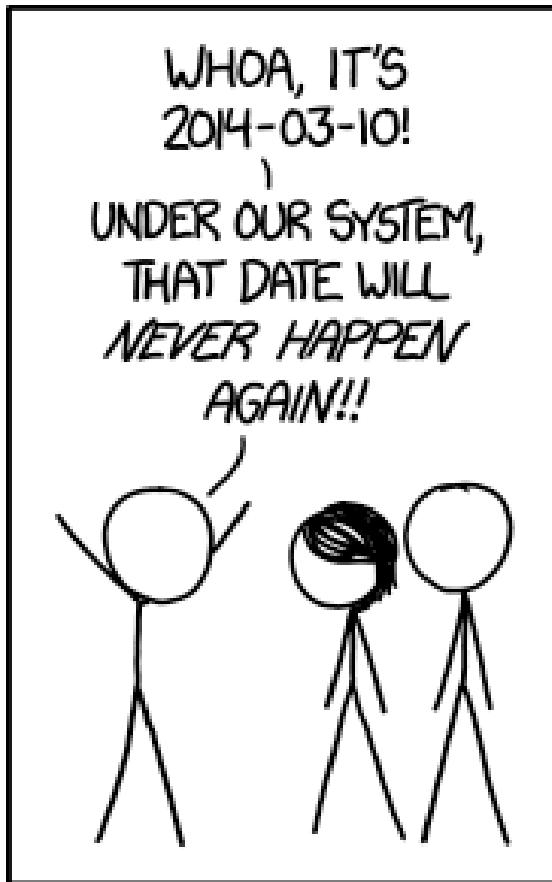
Cueball's response demonstrates that, in life, we make assumptions almost every time we speak. This only tends to be problematic in the few instances where the assumption is wrong.

The title text is a play on the original "assume" pun, breaking down the word "assert", into "ass" and "ert", with "ERT" being an acronym for "Emergency Response Team".

This comic follows a pattern similar to 1657: Insanity.

## #1340: Unique Date

*March 10, 2014*



MY HOBBY: POINTING  
THIS OUT EVERY DAY.

If our current civilization lasts another 8,000 years, it's probably fair to assume the Long Now Foundation got things right, and at some point we started listening to them and switched to five-digit years.



## Explanation

In this comic Cueball excitedly gives the current date (the date the comic was released) in ISO 8601 format (year-month-day) and points out - correctly - that in the current calendar system, this date will never recur.

The calendar used by the USA and most of the Western world is the Gregorian calendar, which counts time using years, months, and days. Since time is perceived to only move forwards,[citation needed] except in some cultures where a cyclical perception of time exists based off the seasons of the year, dates in this system will never repeat and are thus all equally unique, even when the digits aren't in any kind of significant pattern. Unfortunately, Cueball has made it his hobby to point out this uniqueness daily, which would be incredibly annoying to his friends. Even worse, he is using the ISO 8601 date and time standard which is designed precisely to provide unique and unambiguous time references.

Cueball's behavior is a parody of the common practice of finding significance in numerically-interesting dates, such as palindrome dates which have the same digits when reversed (eg. 2nd February 2020, which was 2020-02-02 in the ISO 8601 format). These special dates usually occur infrequently and sporadically, and if using a date format with a defined limit such as ISO 8601 (which only goes up to the year 9999) it is possible for the entire stock of such dates to be exhausted, such that they will never occur again. Some people enjoy finding

and celebrating these special days, treating them as a kind of collector's item to be treasured for their rarity and uniqueness.

Another commonly celebrated date pattern is when the year, month, and day all share the same numeric value - for example, 2001-01-01 (expressed as 01/01/01) or 2012-12-12 (12/12/12), which was the last such date until next century. People might plan special events on these "unique" days. For instance, 2007-07-07 was considered a "lucky" day and had a record number of weddings. This is because humans, in general, are superstitious and like (and recognize) patterns in everyday life.

The title text refers to the Long Now Foundation, which uses five-digit years (e.g. this comic's date would be written "02014-03-10"). This is an effort to encourage people to think in terms of long-term benefits, rather than only the coming years or decades. The Y2K problem was due to using only two digits to store the year, which would have made dates ambiguous when it rolled from 99 back to 00. See also the "Year 2038 problem". Similarly, the Maya calendar had a repeating cycle of 52 years, and even their "long count" rolled over after 7885 years. As we currently use four-digit years this may cause a Y10K problem.

The Long Now Foundation designs a 10,000-year clock that should be able to run for this long — and in principle, it could display every date up to 9999-12-31. 8000 years from the date of the comic would be 10014

AD — Randall jokes that by switching to 5-digit years, we'd prove the Long Now Foundation correct, although of course by this point there would be no other way to show years except by rebooting the calendar.

A previous comic on date formats was 1179: ISO 8601. Randall addresses date formatting confusion again in the title text of 1467: Email.

## #1341: Types of Editors

March 12, 2014

WYSIWYG WHAT YOU SEE IS WHAT YOU GET	WYSINWYG WHAT YOU SEE IS NOT WHAT YOU GET	WYSITUTWYG WHAT YOU SEE IS TOTALLY UNRELATED TO WHAT YOU GET	WYSIHYD WHAT YOU SEE IS HOW YOU DIE
WHAT YOU SEE: 	WHAT YOU SEE: 	WHAT YOU SEE: 	WHAT YOU SEE: 
WHAT YOU GET: 	WHAT YOU GET: 	WHAT YOU GET: 	WHAT YOU GET: 

m-x machine of death-mode

## Explanation

WYSIWYG, pronounced, "wizzy-wig" IPA /'wɪzi,wɪg/, is an acronym that stands for "What you see is what you get". In regards to computers, it refers to text editors in which the user can see exactly what will be published as they are typing it. The comic compares various types of editors, each one a play-on-words on WYSIWYG.

- A WYSIWYG editor displays the edited document in its final form. This could be a printed paper, a web page, a PDF document, and more. This is a real term used for text editors.
- A WYSINWYG editor is the opposite; there is a distinct difference between what the editor displays, and what will be printed. Hence, what you see is not what you get. They are also known as source editors, such as a wiki markup editor or TeX. In the comic an HTML source editor is shown, where you enter raw HTML code and then presented with the rendered appearance of the final page. The `<em>`-tag marks text that has stress emphasis.
- The WYSITUTWYG ("... is totally unrelated to ...") editor apparently takes your input and proceeds to ignore it entirely, instead displaying unrelated words. Possibly a commentary on the Autocorrect function. Randall seems to have made this term up. The phrase "The HORSE is a noble animal" may be a reference to the stereotypes commonly associated with horses, or possibly to Houyhnhnm in Gulliver's Travels, an

extreme version of those stereotypes. "The horse is a noble animal" is also the name of a giant rocking-horse sculpture in Yorkshire.

- WYSIHYD ("... is how you die") shows an "editor" which is not really an editor at all, but rather a pun on the multiple meanings of the word "get": If you see "eaten by wolves", you will get... eaten by wolves. As in physically attacked and devoured by wolves. This is an example of the use-mention distinction, or simply get meaning "to receive" or "to become" (compare German's different evolution: werden ("to become") but bekommen ("to receive")).

The title text is a fictitious command, meta-x machineofdeath-mode, to the highly extensible Emacs text editor. Emacs operates in various "modes", which are customizations for specific purposes. Placing Emacs into "Machine of Death" mode would turn it into a WYSIHYD editor. (For another fictitious emacs command see 378: Real Programmers). See below for why this was used.

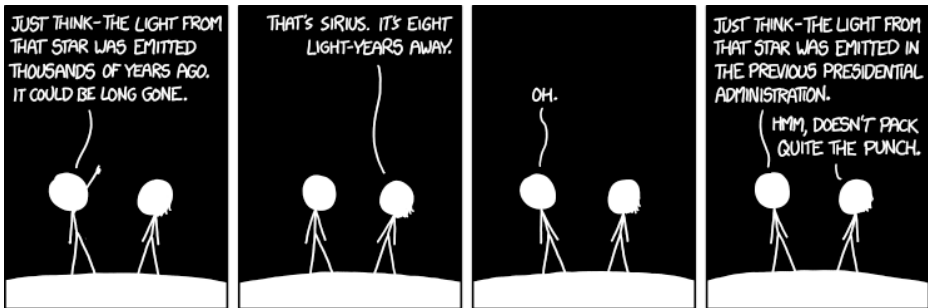
## **Machine of Death book[edit]**

The title text is a reference to "Machine of Death". This book from 2010 is a collection of short stories edited by amongst other Ryan North (of Dinosaur Comics) mentioned here since the idea was based on one of his comics. Since Randall Munroe wrote one of the stories the reference is very likely, and would be Randall's first book promotion in xkcd, but not the last. All the stories are based around a device, the "Machine of Death", that can predict, with 100% accuracy though generally with extreme ambiguity,

how people die from a drop of their blood. In many of the stories very unusual deaths are predicted, often in a very literal way, but not so you know when or where you will die. From the official home page the entire book can be downloaded for free as a PDF file. Randall's story begins on page 421 - or page 218 of the two-sided PDF file. It is simply called "?". In 1525: Emojic 8 Ball the default question is How will I die? and can then be answered by an Emojic 8 Ball, which would make it a type of Machine of Death.

## #1342: Ancient Stars

March 14, 2014



'The light from those millions of stars you see is probably many thousands of years old' is a rare example of laypeople substantially **OVER**estimating astronomical numbers.



## Explanation

Cueball makes the common observation that many of the visible stars in the sky are so distant that it takes thousands of years for light from that star to reach Earth. However, the brightest star Sirius is one of the nearest at a mere 8.6 light-years distance. In other words, the light that was arriving from Sirius in March 2014, when the comic was posted, was emitted some time around August 2005. The previous US president, George W. Bush, was in office from 2001 to 2009 and Megan notes that this isn't a terribly impressive observation. At certain times (mostly when the previous US president served only a single term, but also currently for a short time after the inauguration of any incoming president), looking to events of 8.6 years ago would stretch beyond just the prior administration, but even two (rarely being three, or possibly even more) predecessors ago would not be considered impressive in the circumstances.

The title text references the fact that most people have a hard time imagining the large scale of astronomical numbers. For example, the distance between astronomical bodies or the size of the Sun are hard to imagine; they typically underestimate them by many orders of magnitude and think they are much smaller than they actually are. See *Sci-Fi Writers Have No Sense of Scale*

In this case, however, people instead overestimate both the number of visible stars and their distance by quite a

bit. This could be a result of underestimating the speed of light, which is rather fast. Even though stars are incredibly far away (Sirius's 8.6ly translates to over 80 trillion kilometers), light is so fast that it can cross those distances as fast as anything can (a relative blink in the eye, for the nearest of these vast distances). This underestimate of light results in an overestimate of the time it takes for light to reach us.

It's frequently cited that about 5,000 to 10,000 stars are visible in the sky by the naked eye. The Bright Star Catalogue is a star catalogue that lists all stars of apparent magnitude 6.5 or brighter, which is roughly every star visible to the naked eye from Earth. The catalog contains 9,110 objects, of which 9,096 are stars, ten are novae or supernovae, and four objects outside of our Milky Way (two globular clusters and two open clusters). To see most of these you need good eyes and a very dark night, and at any point you will only be able to see fewer than half of these as the rest are blocked by the Earth.

This list shows the 93 brightest stars. Of these 60 are more than 100 light years away and only 7 are more than 1,000 light years away. The farthest on this list, Deneb, is "only" 2,600 light years away. Our entire Milky Way contains up to 400 billion ( $400 \times 10^9$ ) stars and has a diameter of 100,000 light years.

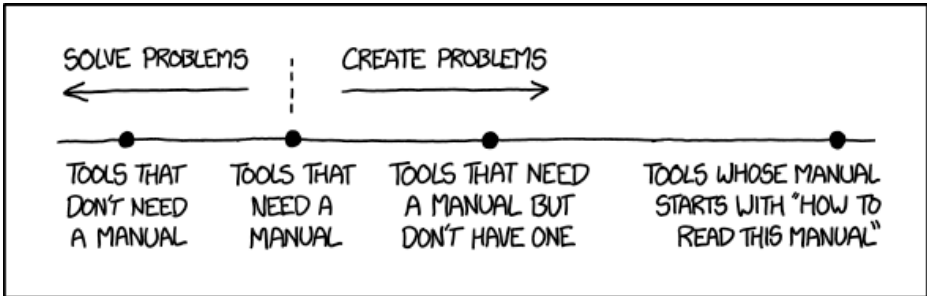
There are visible objects much farther away, like the Andromeda Galaxy which is 2.5 million light years away and made up of billions of stars. And a gamma ray burst GRB 080319B would have been briefly visible to the

naked eye, despite being 7.5 billion light years distant.

See also 1212: Interstellar Memes, 1644: Stargazing and 1440: Geese.

## #1343: Manuals

March 17, 2014



The most ridiculous offender of all is the sudoers man page, which for 15 years has started with a 'quick guide' to EBNF, a system for defining the grammar of a language. 'Don't despair', it says, 'the definitions below are annotated.'

## Explanation

The chart shows the quality of tools regarding their manual:

- If you don't even need a manual to use a certain tool, that tool tends to help solve problems effectively.
- If you do need a manual, the tool will probably solve the problems but you have to understand that manual before you can use this tool effectively.
- Much less helpful are the tools where you need a manual but it doesn't exist — these tools tend to create more problems than they solve.
- But the worst tools are where the manuals start with a description of the manual itself — which implies both that the tool is very complex and the manual is very hard to understand, or has low expectations of its viewers.

The title text refers to `sudoers`, a config file for the unix command `sudo`. `sudo` allows users to run a program with elevated permissions, as referenced in 149: Sandwich. Man pages are collections of manuals for different tools, commands, files, and functions on Unix-like systems which can be viewed with the tool `man`. You can type `man man` in a terminal to get the manpage for the manual program. See for instance also the comic 912: Manual Override.

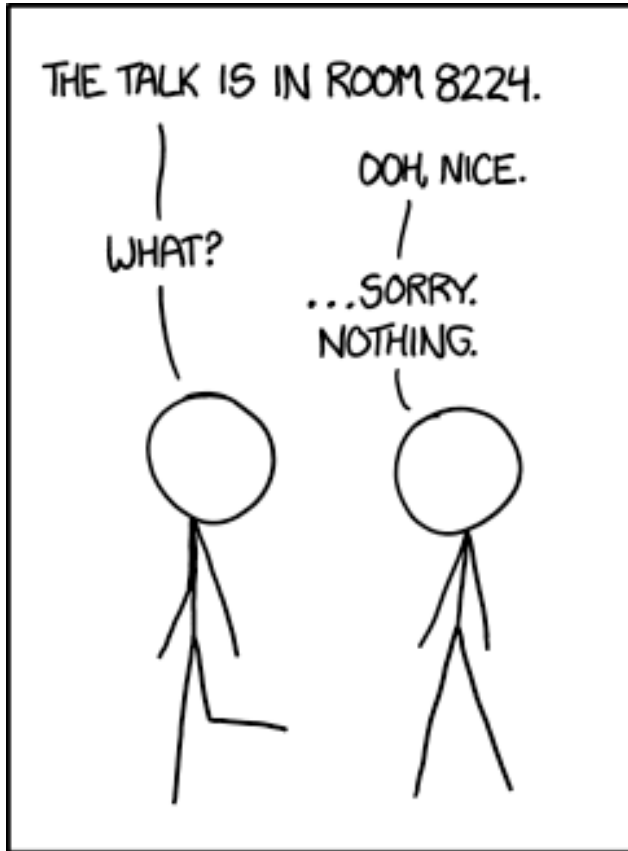
The `sudoers` file specifies which users have `sudo` access,

and which commands they are allowed to run as other users (typically root). The syntax of the file is very complex, and the manpage uses the Extended Backus–Naur Form (or EBNF) to describe the syntax. The sudoers man page starts off with an explanation of EBNF's grammar, which they reference throughout the rest of the man page in describing the syntax of the sudoers file. The sudoers man page is very long, clocking in at 1504 lines. In contrast, the manpages man page only has 566 lines. The number of lines may differ between some distributions and versions.

The title text also notes that the manual's assurance, "don't despair" because "the definitions below are annotated", fails to be reassuring, and instead merely emphasizes the length and complexity of the document to read.

## #1344: Digits

March 19, 2014



GREAT, NOW I'LL SPEND THE REST  
OF MY LIFE NOTICING NUMBERS THAT  
WOULD MAKE GOOD 2048 COMBOS.

It's taken me 20 years to get over skyline tetris.

## Explanation

2048 is a popular browser-based game in which players must move tiles in a 4 by 4 grid with numbers on them. When two tiles of the same number touch they can be merged into one tile with a value of the two tiles combined. So when two 4-tiles touch and are merged they form one 8-tile. The player can move the tiles by pressing an arrow key (or swiping in a direction on the mobile version), which will move all the tiles in that direction. Every time the player makes such a move another tile will appear on a random cell. The goal of the game is to get a tile with the number 2048.

In the comic the room number can be seen as 4 tiles with the values 8, 2, 2 and 4. If these occur in the game the player can merge the two 2-tiles into one 4-tile. This will then cause two 4-tiles to lie next to each other, so these can be merged into one 8-tile. Finally, the two 8-tiles can be merged into one 16-tile.

This can be done in the opposite direction as well.

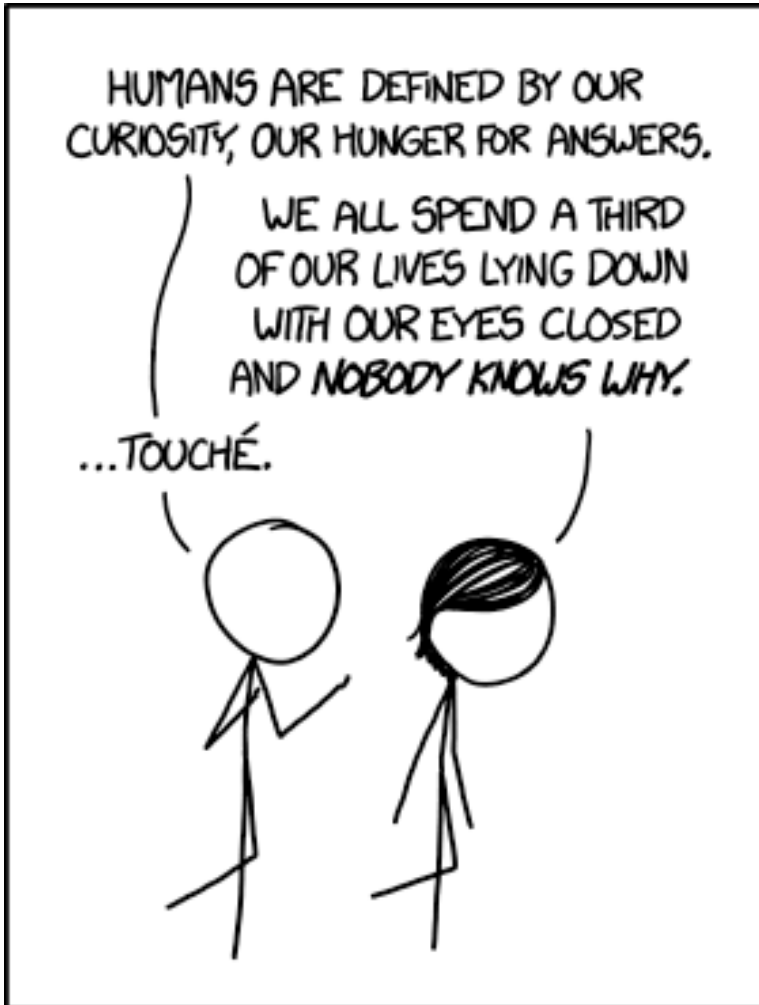
The title text refers to Tetris effect, which takes its name from the game Tetris. People who play Tetris for extended periods tend to imagine real-life objects (like skylines) as Tetris landscapes and pieces. Randall, as many others, apparently got hooked on Tetris so much when it came out that, for 20 years, he would look at city skylines and see Tetris-like patterns in it. Similarly, he has now been hooked onto 2048 and notices number



patterns that would be desirable to obtain during the game.

## #1345: Answers

March 21, 2014



Stanford sleep researcher William Dement said that after 50 years of studying sleep, the only really solid explanation he knows for why we do it is 'because we get sleepy'.

## Explanation

Cueball claims that humans are driven by their curiosity, which is never-ending. Megan responds by noting that everyone spends approximately eight hours per day in an unconscious state of sleep, but no one has yet pinned down the biological purpose of sleep. Despite this obvious mystery, most people aren't "losing sleep over it." This implies that Cueball's observed curiosity has a perceptible and proximate limit.

This is not to suggest that scientists aren't researching sleep; scientists frequently conduct sleep studies — we just haven't found any satisfactory answers yet. Some popular hypotheses are to allow the brain a period to consolidate memories and to give the body a chance to repair itself.

The title text quotes William Dement: people sleep "because we get sleepy." (Secrets of sleep). This of course is dodging the underlying issue. That this non-explanation is the best answer that a leading sleep researcher can provide, shows how little anyone knows about the subject. This may be an oblique reference to the dormitive principle of the French playwright Molière, who created a satirical character who claimed to have discovered the answer to a popular question: The reason opium makes someone sleepy, said the character, a doctor, was that it contained a "dormitive principle" (i.e., something that makes someone sleepy).

In 203: Hallucinations, Randall expressed similar surprise at the lack of interest in the nature of sleep.

The phrase "and nobody knows why" is commonly appended to urban legends, as in A duck's quack doesn't echo, and no one knows why. The implication is that something mysterious is going on and scientists are puzzled. 1186: Bumblebees is another "nobody knows why" example.

## #1346: Career

March 24, 2014



WHEN PEOPLE ASK ME TO DESCRIBE MY DREAM  
JOB, I'M NEVER SURE HOW REALISTIC TO BE.

They'd convince me to come out of retirement for one last job: biting into a giant lump of slightly soft wax a couple of times.

## Explanation

Cueball is presumably asked to answer the typical career counselor question: What is your dream job? Rather than going with the more common answers that are designed to increase the chances of landing that particular job, Cueball talks about unrealistic jobs that are whimsical, and so well compensated that a little over one hour on the clock would provide enough wealth for a luxurious retirement; of course, you can have such a job only in your dreams. He makes jobs out of tasks that people do when they are bored, whether the tasks needed to be done or not. Therefore, if he did not get the job he probably would have done them at some point anyway.

Peeling lint off dryer traps can relieve boredom, but it gets tedious soon, so Cueball wants to do that only for 5 minutes, followed by an hour of holding the handle of a lightsaber against things and switching it on. The energy emitted by this fictional weapon will probably burn, melt or cut the object it is touching as demonstrated in a scene from Star Wars Episode I, where Jedi Qui-Gon Jinn uses his lightsaber to cut through a wall. Later, Star Wars: The Last Jedi turned out to demonstrate a lightsaber being placed against something before being switched on-- on the head of a Praetorian Guard. Obviously, it would be impossible to find a job like this, let alone one with a salary allowing one to retire to a life of luxury.[citation needed]

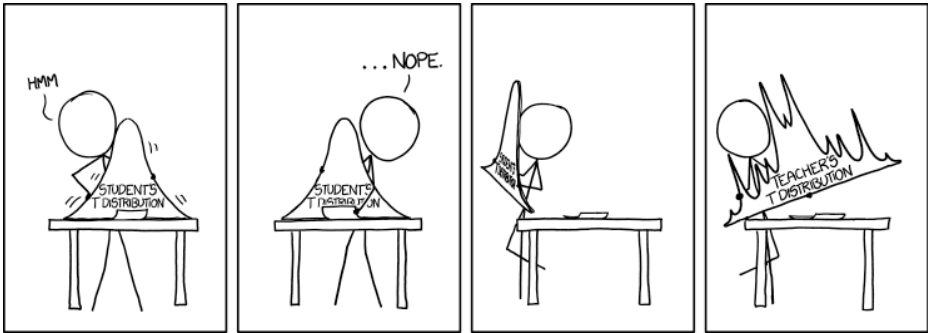
The title text is poking fun at Hollywood films,

particularly stories about violent professions (like mobsters, hitmen, detective or spies) where the hero is retired, but some unforeseen circumstance has forced them out of retirement to do "one last job." Usually in these films, the jobs are overtly, improbably dangerous, often with the suggestion that they may lose their lives doing it, but the reward for doing the job (saving the world, a ton of cash, an unresolved/resolved debt) is just too great to refuse. However, in this comic the joke is that his "one last job" is also a mildly amusing task designed to relieve boredom.

An alternative explanation may be that these activities are very sensationally unique and satisfying for certain types of people, such as those with autism, and that this dream job is simply getting paid absurd amounts of money for something they wanted to do anyway. Or, "dream" may be taken literally, and these may be jobs that Cueball has had in his dreams, given the strange nature of them.

## #1347: t Distribution

March 26, 2014



If data fails the Teacher's t test, you can just force it to take the test again until it passes.



## Explanation

The Student's t-distribution is a class of probability distribution used in statistics to model small sample sizes. "Student" was the pseudonym of William Sealy Gosset, an employee of Guinness Brewery who discovered it.

A Student's t distribution is similar to a normal symmetric bell curve distribution, but has "fatter tails"; thus, the one shown in the comic is roughly the right shape. A "Teacher's" t-distribution is a joke (pun) made up by Randall.

The comic is a play on the name "Student", the pseudonym of the creator, versus the "Teacher". The idea is that a "teacher's" distribution would be more complex, and that it would be used for fitting data when the student's distribution wasn't sophisticated enough. Of course, in actuality, such a complex distribution as the one shown in the comic would have many parameters, and in practice would probably lead to overfitting and/or bias. Thus, the comic (and the title text) can be seen as making fun of the idea that more complex is always better, or perhaps of the idea that a statistician's job is to use more and more sophisticated tools to force the data to yield a "publishable" result, rather than to use the simplest appropriate tool and let the chips fall where they may.

Cueball tries to "fit" a distribution to the data on the paper. This is the usual jargon for when a statistician is

trying to model their data as coming from some underlying probability distribution, and the comic makes a pun with the physical meaning of "fit". In the second panel, Cueball decides that the Student's T distribution does not fit his data well (the data failed the Student t-test), and decides to pull out the more complex Teachers t-distribution instead (the teachers t-test - which the data is not allowed to continue to fail). Note that "test" is what statisticians do to data to see if it fits some distribution, but it is also another word for "examination."

The Student's t distribution relates the average of a small sample to the "true" population average, under the assumptions, unobjectionable in many contexts, that there is such a "true" value, and that the samples are independent and normally distributed with equal variance. As such, unless the data on Cueball's paper contain many small groups which radically violate these assumptions somehow, there is no way Cueball's data could falsify the t distribution. In particular, a single number (for the average of one group) or a small set of numbers (for the averages of several numbers) will never make a nice smooth curve, but an average statistician would see that as normal statistical noise that would even out over time, not as a reason to prefer a complex, spiky curve such as the supposed "teacher's" distribution. But of course, Cueball's access to a secret, cooler-looking distribution makes them more badass than a mere average statistician... or does it?

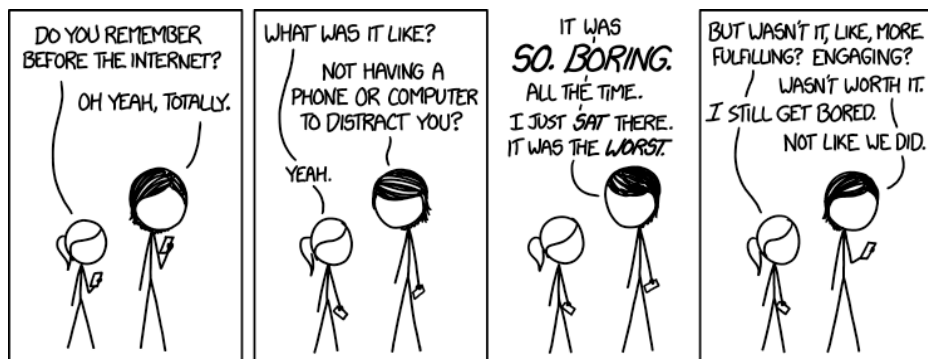
Ironically, the Teacher's T Distribution shows equal

variance, itself proving the appropriateness of the Student's T Distribution.

The title text plays on the word "test". The first part of the sentence refers to a potential "Teacher t-test" which would be used in a statistical context to test for the significance of some observation, as opposed to the real "Student's t-test" which is used to determine if two sets of data differ by a statistically significant amount. On the other hand, the second part of the sentence refers to the possibility for students to take tests (or exams) until they pass - or to teachers who forces students to take the test again and again until they pass. The resulting sentence may refer to statistical fallacy, or the (conscious or unconscious) action of manipulating observations or misconducting experiments to give statistical significance to a false fact.

## #1348: Before the Internet

March 28, 2014



We watched **DAYTIME TV**. Do you realize how soul-crushing it was? I'd rather eat an iPad than go back to watching daytime TV.

## Explanation

A young Ponytail asks Megan what life was like before the Internet. The girl, obviously, was born after the Internet was invented, became widely known about and/or attained its current level of ubiquity. (Those milestones are spread wide, and are often confused with each other. A young child of indeterminate age, in 2014, might possibly have been born slightly before the latter became all but indisputed, but without much memory of it.) Megan responds that life was very boring without computers or mobile phones. This comic appears to be a parody of the common complaint — often done by elder people — that life was better and more fulfilling in the "good old days", in that there weren't so many distractions and people could actually get things done that were meaningful. The ages switch roles with the younger character being prepared to believe that life was more fulfilling before technology, and the elder rejecting the proposition.

To Megan, even a more fulfilling and engaging life "wasn't worth" the price of what it meant to be bored in the days before smartphones and computers that could go online. Even though the ponytail girl says that she still experiences boredom in spite of having advanced technology to occupy her, Megan assures her that her version of boredom is nothing like what those in the pre-Internet days had to endure. Again, this is a reversal of the typical exchange in which a young person tries to insist that they still have social contact/get out and

about/do worthwhile things in their spare time, and the elder person responds, "Not like we did."

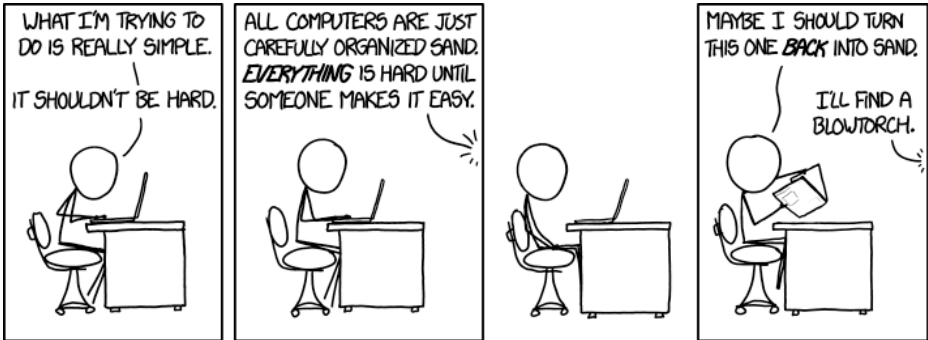
The title text continues in this vein as Megan talks about what people in her day resorted to doing when they were bored, for lack of anything better to do: they watched daytime TV. Daytime television consisted mainly of soap operas, talk shows, game shows, infomercials and children's programming and is notorious for being, in Megan's words, "soul-crushing". To round off the comparison, Megan uses a modern-day metaphor to express her extreme distaste for daytime television, saying that she would rather "eat an iPad" than go through that again. In other words, modern-day gadgets are so much better that she'd still have more fun if she were eating them than if she had to go without them. Alternatively, it could be to emphasize how unpleasant daytime TV is; eating an iPad would likely be unpleasant (e.g. it is too large to easily be swallowed whole and too hard to easily be bitten into parts), and it could poison her or give her an internal electrical or battery fire. Saying that she would rather eat an iPad would also be a powerful statement because Megan would not be able to watch movies, play games, read the news, etc... on that iPad after eating it[citation needed] (although she could just buy another iPad—at least if she survives the battery of the iPad that she ate leaking and/or exploding and other hazards associated with eating an iPad).

Megan might just be responding with the opposite of what she's expected to say in this dialogue in order to mess with the younger girl. In reality, life was neither

likely to be noticeably more fulfilling or noticeably more boring without technology: it was just life. People are equally capable of wasting their time and of doing worthwhile things regardless of what age they live in, and those who wax nostalgic about an older, better time are liable to forget that. This recalls the Hedonic treadmill theory which states that people will always be at roughly the same level of happiness regardless of positive or negative events or technological advances in civilization.

## #1349: Shouldn't Be Hard

March 31, 2014



(six hours later) **ARGH.** How are these stupid microchips so durable?! All I want is to undo a massive industrial process with household tools!



## Explanation

This comic refers to a sentiment sometimes expressed by computer users that "what I'm trying to do is really simple — it shouldn't be hard." The statement demonstrates an assumption that because the desired action is conceptually simple, it must therefore be simple to implement. There is a logic to this line of thinking, but in reality, as the off-screen character notes, a computer is a very complicated set of components which effectively can't do anything (simple or complex) until someone has programmed the functionality into it. Even more abstractly, a random silicon crystal can't do anything at all until someone has applied a complex industrial process to it that allows it to read and execute computer code in the first place.

In terms of a user-interface, the "simplicity" of executing a given task may be more a function of the perceived utility and frequency-of-use of that function, and less a function of its conceptual "simplicity". For example, changing the color of the font in a word processor is often simpler than changing the color of the background/page, even though changing colors of two parts of the document would appear equally "simple" in concept. The different implementation is a design choice by the programmer most likely on the basis that the intended user is considered more likely to want to change the font color than to change the page color.

This sentiment equally applies to computer

programmers: most commonly when they are just beginning to learn a new computer language. Sometimes because of difficulties with the syntax rules of the language or similar problems, a programmer may spend a long time trying to get the computer to do a simple action, such as display a message on the screen, or ask the user for a number. This is also true when a programmer is working in a language which doesn't have an easy way to do something that might be simple in another language. And in computer science, it may often be very hard to differentiate the almost impossible from the easy, especially when compared to what humans can and can't do easily.

The off-screen character points out that computers were "just carefully organized sand". Modern computer chips are made largely of silicon crystals, chemically a part of silicon dioxide crystals that compose the majority of sand. The character puts Cueball's goal in perspective by pointing out the large amount of complexity required to make, what is essentially sand, do even the simplest of computational tasks.

The punchline of the comic is that, after considering these words of wisdom for a panel, instead of the anticipated response of Cueball coming to the realization that the off-screen character is right, and working even harder to solve his problem, Cueball instead succumbs to his annoyance and sets out to destroy his computer (which he characterizes as turning it "back into sand"). The off-screen character helpfully offers to get a blowtorch so that Cueball can melt the computer down

into simple compounds and elements.

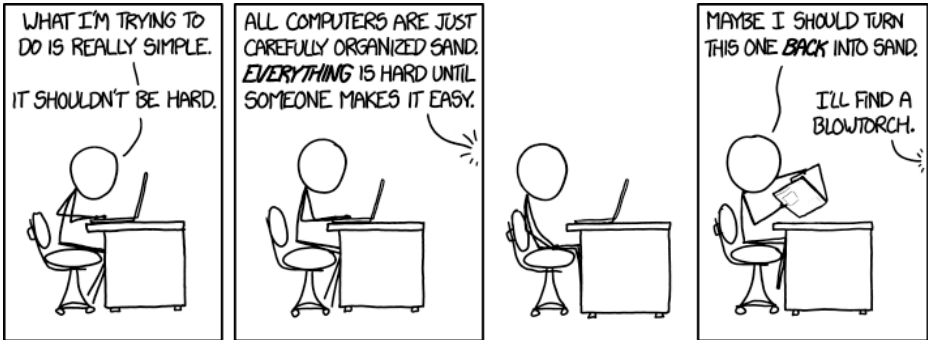
The title text sees Cueball again frustrated with a task he considers "simple" (destroying the computer). Cueball appears to be oblivious to the irony in his statement that he is having trouble destroying something with household tools that required very large machines and an industrial process to create. This might be compared to trying to undo a steel weld by lighting a wooden match and trying to melt the weld with it. This points out the irony that destroying the processor is even harder to do than the task from the first picture.

The melting point of silicon is 1,414 °C. Although a typical butane blowtorch that might be found in a kitchen has a maximum temperature of 1,430 °C, that temperature is at a very small point and rapidly cools. Hence it is unlikely that you could focus sufficient heat with a kitchen appliance blowtorch to actually melt silicon.

The apparently simple task Cueball is trying to complete may express Randall's frustration in the creation of the crowd-sourced comic 1350: Lorenz, which was launched the next day and initially contained a large number of bugs.

## #1350: Lorenz

*April 01, 2014*



Every choice, no matter how small, begins a new story.

## Explanation

This was the fifth April fools' comic released by Randall. The previous April fools' comic was

1193: Externalities from Monday April 1st, 2013. The next was 1506: xkcloud released on Wednesday April 1st, 2015. This comic was posted a day earlier than normal (on Tuesday instead of Wednesday) to honor April Fools' Day of 2014.

This is an interactive and dynamic comic similar to the Choose Your Own Adventure series, where players flip to different pages based on the option they chose. The first picture shown on top of this page is the start of this comic, with a possible combination of text options to choose from (see above). The picture is always the same but the order of the four sentences (and the sentences themselves) is chosen randomly (and there can be more than four). The result of all the interactions by the readers led to the generation of crowd-sourced content.

The title 'Lorenz' is referring to Edward Norton Lorenz who, among other subjects, was famous for Chaos theory and the Butterfly effect (mentioned later in the title text of 1519: Venus). This comic is an example of a Choose Your Own Adventure story, as mentioned in the title text.

The title text is also a reference to how the storyline of this comic will be chaotic by nature, since it includes all of the user submitted dialogue and updates over time

based on statistics of user clicks. In this manner, it is a reference to the butterfly effect: a phrase coined by Edward Lorenz to describe how a small initial change can lead to wide variations in outcome in a chaotic system.

Every time a story comes to a point where the user can either choose something or contribute when asked to Suggest a line, a link will appear by hovering the mouse over the bottom right corner of the last image. This is named a permalink, as it is a link that will recreate this particular story up to the point, making it permanent. It will not save the options listed below that image (i.e. the order of these will change, new options may appear, either because more than four are already present or new options will be added and some options may even disappear). An option is thus only saved by choosing it and then saving the next permalink — see more below.

Any particular storyline will typically only have one or two of the many themes possible in the comic, but some very long stories may have several: see the Record section below. Several of the themes refer to previous comics or generally recurring themes in xkcd. (Most obviously is the blowtorch theme which is a reference to the previous comic 1349: Shouldn't Be Hard, where the last comment is I'll find a blowtorch as a response to Cueball's frustration over his problems.)

Because it is not always ending as "well" as with a burnt PC, they might instead end up in a shark infested ocean — see the Ocean theme, which is a reference to 349: Success: a comic that came exactly 1000 comics before

the other one referenced in the same computer problem theme. In that comic, the sharks had not appeared yet; but here there may be several (and sharks are also a recurring topic in xkcd).

These issues with computers is generally a reference to the computer problem themes that precedes both the burning of the laptop and the ocean storylines, as Knit Cap tries to install BSD; and when it fails, she takes her friend Hairy with her in the fall, the water, space or into a Pokémon fight (as they are the two main character of this comic). Also Cueball (as a politician vs. another politician with hair) and White Hat have small appearances, but only in a small section of particular storyline. Only few others interact directly with the main characters in the rest of the possible stories.

Other themes that are recurring in xkcd are Politics, Pokémon, Boomerangs and Dinosaurs. Dinosaurs enter the comic in the form of the green talking T-rex from Dinosaur Comics: a clip-art-based webcomic that uses the same artwork with different captions for every strip. This particular Dinosaur Comics has a title text that actually refer to Randall and xkcd, and the comic has previously appeared on xkcd in 145: Parody Week: Dinosaur Comics.

A way to combine more than one storyline is to let characters wake up from a dream or a nightmare, as can be seen in the Dreams theme (and dreams are also a recurring topic). Here, it can even get recursive, so there can be dreams within dreams. One of the ways to wake

from a dream is, of course, by encountering a dinosaur that tries to step on your house (with you inside). Another is in reference to the possible rocket trip that may take the characters into space: see the Space theme (another recurring topic).

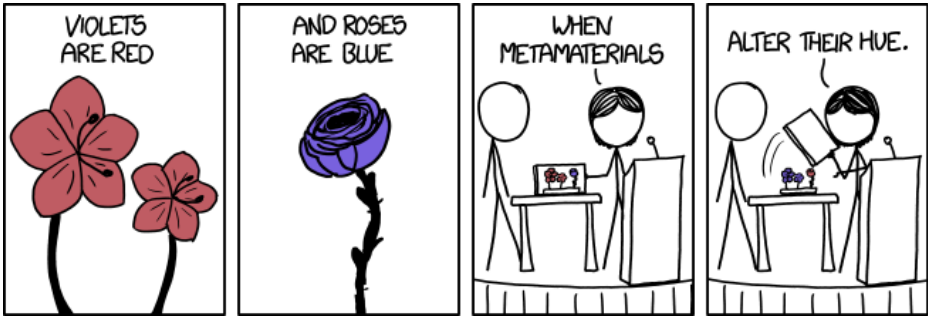
There are a few other topics that are covered by Randall himself, but many others will be referenced in the text in the comic. However, since most of the options the users have is in itself created by user input (including naming the characters different names), any reference made by the text is not considered part of Randall's work and thus only sporadically be mentioned below under the themes section and not be included as a category. Here is an example with a permalink where the last comment, in the ocean with a shark, references Malaysia Airlines Flight 370 that disappeared less than a month before this comic was released [and has yet to be found years later]. But this is a user input, not Randall's.

Some of the idea of this comic was used again in the next year's April Fools' comic 1506: xkcloud, where user input also generated a very complex comic, and the concept of permalink was used again. This comic was the first time that Knit Cap has a main part to play.



## #1351: Metamaterials

*April 04, 2014*



If I developed a hue-shifting metamaterial, I would photobomb people's Instagram pics with a sheet of material that precisely undid the filter they were using.

## Explanation

Metamaterials, artificially-created structures typically made from several materials in a microscopic checkerboard pattern, are famous for allowing bizarre optical properties, such as invisibility cloaks. This comic imagines that metamaterials can change the color of light passing through them.

In the real world a metamaterial can alter the spatial distribution of light and also its frequency, like done in fluorescent lamps — but this would not resemble the entire picture in a different color. In photography many filters are used to enhance the quality and appearance of the image. These filters do not alter colors but block some of them, so the result is shown in a different color than the original. Nevertheless, no application like this is able to switch a single color to another as it can be done by most modern computer photo programs.

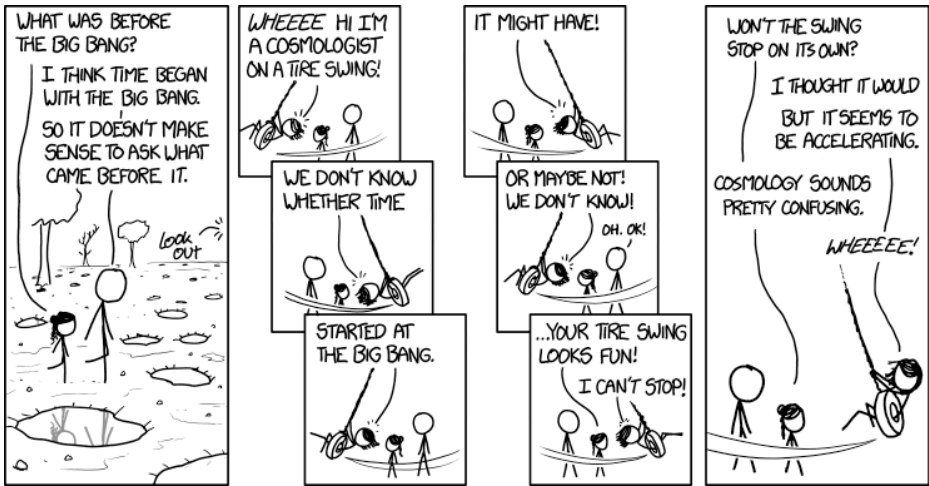
Megan uses a box made of her metamaterial to switch the colors of the cliché Valentine's Day poem, "Roses are red, violets are blue, sugar is sweet and so are you."

The title text references this with Randall pondering making a metamaterial that reverses the effect of instagram filters, likely by placing the material between the camera and the subject just before the picture is taken without the photographer noticing - a so-called photobombing. Instagram is a photo application that applies one of a variety of filters like hue-shift or contrast

adjustments meant to simulate the look of old photographs. These filters may be able to interchange blue and red - as they are not real material filters.

## #1352: Cosmologist on a Tire Swing

April 07, 2014



No matter how fast I swing, I can never travel outside this loop! Maybe space outside it doesn't exist! But I bet it does. This tire came from somewhere.

## Explanation

Cueball and the curious Jill walk through a landscape with trees in the background and with many small pools of water. The setting of trees interspersed with these many small pools resembles the Wood between the Worlds, a meta-verse described in C.S. Lewis's *The Magician's Nephew*; each pool leads into a different universe — one of these is ours, another is Narnia, and Charn (the world of Jadis the White Witch) is also visited through these pools.

Jill asks about the time before the Big Bang. Cueball says he thinks there was no time before — which is implied by most forms of the Big Bang theory. But then they happen upon a cosmologist, Megan, on a swing who has several other theories about the universe.

Simply put, the tire swing is a symbolic representation of our universe. Scientific observations tell us that both space and time began with the Big Bang ~13.8 billion years ago. We don't know if there was such a thing as "before" the universe, or what that might be.

The first 6 panels reference ongoing speculation about where the universe came from and why it even exists in the first place. The last two panels relate to recent observations of the accelerating universe in which galaxies are now receding from each other at higher and higher speeds, due to dark energy.

The swing itself is likely a reference to the Cyclic Model, where the universe expands from a Big Bang, then contracts back in on itself under its own gravity for a Big Crunch, before bouncing outward again in another Big Bang, and repeating the whole process. On the other hand, the swing is accelerating as the universe — so it may also be a reference to the entire universe. We are all "trapped" on this swing — and it's accelerating! For the layperson (and most scientists as well) cosmology is pretty confusing as Jill states at the end, to which the cosmologist just replies Wheeeee! and enjoys her ride with this accelerating swing/universe.

Another interpretation of the acceleration may refer to the physics of orbital motion in which a centrifugal force is always causing constant acceleration toward the center of the motion.

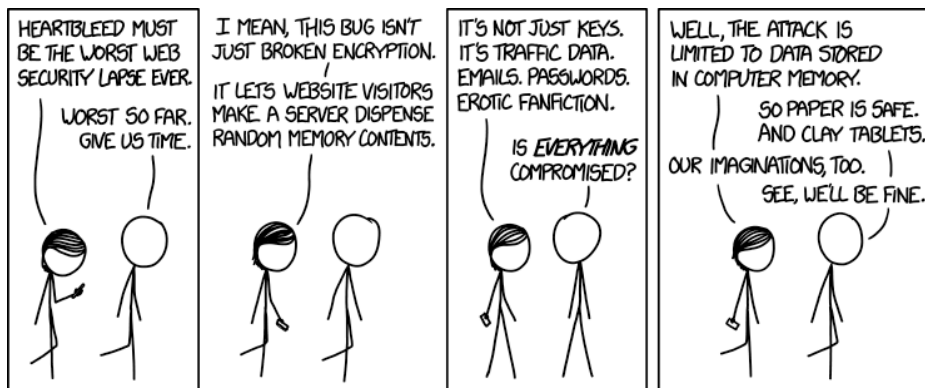
The title text references questions about the shape of the universe and what could lie "outside" of it. By the current understanding on physics laws, we can't see outside of the observable universe, but it's likely that the universe is bigger than this observable universe and uniform on large scale. Even though nobody can leave our own universe, Megan bets that such unknown worlds do exist - because this universe is here, and it must have come from somewhere — like her tire.

The shape of our universe was visited soon after in 1365: Inflation where we can see what the outer boundary of our universe looks like.

Jill is seen later in conjunction with a tire swing in 1659:  
Tire Swing; maybe she is preparing to become a  
cosmologist herself. Also, this may explain from where  
the tire came from...

## #1353: Heartbleed

*April 09, 2014*



I looked at some of the data dumps from vulnerable sites, and it was ... bad. I saw emails, passwords, password hints. SSL keys and session cookies. Important servers brimming with visitor IPs. Attack ships on fire off the shoulder of Orion, c-beams glittering in the dark near the Tannhuser Gate. I should probably patch OpenSSL.



## Explanation

The Heartbleed bug refers to a critical bug in the OpenSSL cryptographic library. This bug was publicly revealed on Monday, 7 April 2014. Due to a programming error in OpenSSL versions 1.0.1 through 1.0.1f — meaning the bug had existed for two years — attackers could read random server memory by sending specially prepared HeartbeatRequest messages to an affected server.

OpenSSL is a very commonly used library to implement SSL/TLS, a cryptographic protocol not only used to secure web traffic but also for mail clients and much more. Only the user and the server can read the communication. On the web the protocol is `https://` (HTTP Secure), instead of the open `http://` standard. SSL is often used to protect sensitive web traffic, such as login requests, which contains the usernames and passwords in the requests. The server sends a certificate to the browser before the secure connection is established. If the certificate is registered the browser accepts it automatically, otherwise the user gets a popup to accept or reject this insecure certificate.

A vulnerability that lets an attacker read random clumps of memory on the server would possibly let an attacker find recent username/password requests, allowing them to gain unauthorized access to user accounts. Even worse, this vulnerability could read the server's private key, enabling anyone to impersonate the server and/or

decrypt any future traffic that relies on that key, and any previously obtained prior traffic also, unless a "perfect forward secrecy" cipher is used. Furthermore, the Heartbleed exploit occurs during the handshake phase of setting up a connection, so no traces of it are logged, i.e. you can be attacked and never be the wiser.

More information is available at [heartbleed.com](http://heartbleed.com) or under the reference CVE-2014-0160 at [nvd.nist.gov](http://nvd.nist.gov).

In the last panel, Megan interprets Cueball's question ("is everything compromised?") expansively. She responds that, being a computer bug, Heartbleed can only affect information which is stored on computers. Cueball concludes that information recorded in analog media, such as that written on paper or etched in clay tablets, is safe. Megan adds that imaginations are also unaffected by Heartbleed, and Cueball is reassured. The reader may wonder how our society would fare in the face of the leakage of all electronically stored private information, but having our imaginations intact is certainly reassuring.

The title text cites the Tears in rain soliloquy, the dying words of the replicant and main antagonist Roy Batty (played by Rutger Hauer) in the 1982 film Blade Runner, implying that the 64KiB Heartbleed buffer is so complete it includes memories from replicant brains. This is ironic as in the soliloquy, Roy Batty stated "All those moments will be lost in time".

The title text also suggests patching OpenSSL oneself, which might refer to the patched version of OpenSSL by

Debian, which turned out to be vulnerable in 2008, and was the topic of 424: Security Holes.

## Heartbleed[edit]

In addition to the below, see xkcd's explanation in the next comic.

Transport Layer Security (TLS), the successor to SSL, is a protocol that provides end-to-end encryption for data transmitted over the internet and is described in RFC 5246. The Heartbeat extension to TLS introduced in 2012 (described in RFC 6520) provides a protocol for keeping an encrypted TLS session alive (preventing inactivity timeouts), so you do not have to do a costly TLS handshake with the server for subsequent transfer of information.

The Heartbeat protocol involves the client sending a packet with an arbitrary payload (often a random 16-to-32-byte number) that the server periodically sends back to the client to tell the client that the TLS session is still alive. When the client sends the packet to a vulnerable version of OpenSSL, the OpenSSL server reads a `payload_size` from the header sent by the client. This is a 2-byte number (0 to 0xffff=65535) that is supposed to describe the size of the payload. The OpenSSL library writes the payload to memory, but it does not check that the size of the payload written to memory matches the `payload_size` taken from the client's header. When the vulnerable server sends back the Heartbeat KeepAlive response to the client, it will readout `payload_size` number of bytes and send them back to the client. If you send a payload that is actually 16 bytes, but claims it is 0xffff bytes you will read the next 64KiB of memory of the vulnerable process starting from wherever the payload was written. An attacker can

repeat this attack many times and can do this attack early in the TLS handshake, so the attack will not in any way be logged unless they are logging every incoming packet which is not typical and would result in many passwords being logged. As private keys often have an identifiable format, it is often possible for an attacker to find the private TLS key, so if they eavesdrop on network traffic they can decrypt and/or alter it. For more detailed information see: 1, 2, 3.

It is worth noting that modern operating systems use a virtual memory abstraction above physical memory. This means every process can only access memory assigned to it, so it would be impossible for a vulnerable web server to read memory assigned to another process (like a text editor that has erotic fan fiction stored to memory) on the same computer. For more info, see: 4.

It also should be noted that this Heartbleed bug only affects certain versions of OpenSSL, and does not affect other TLS/SSL implementations, or OpenSSH which does not even use the TLS protocol but uses the SSH-2 protocol (described in RFC 4251). SSH is typically used for remote logins on Unix and Linux computers.

Vulnerable sysadmins need to update to a patched version of OpenSSL or one with the Heartbeats disabled. Unless their TLS keys were protected by hardware, they probably also need to revoke their old TLS keys and generate new TLS keys. To learn how to do this visit Leo Green. There you will find all the information you need.

Users of vulnerable systems should change their passwords after the sysadmins have revoked their old key and issued new ones (as

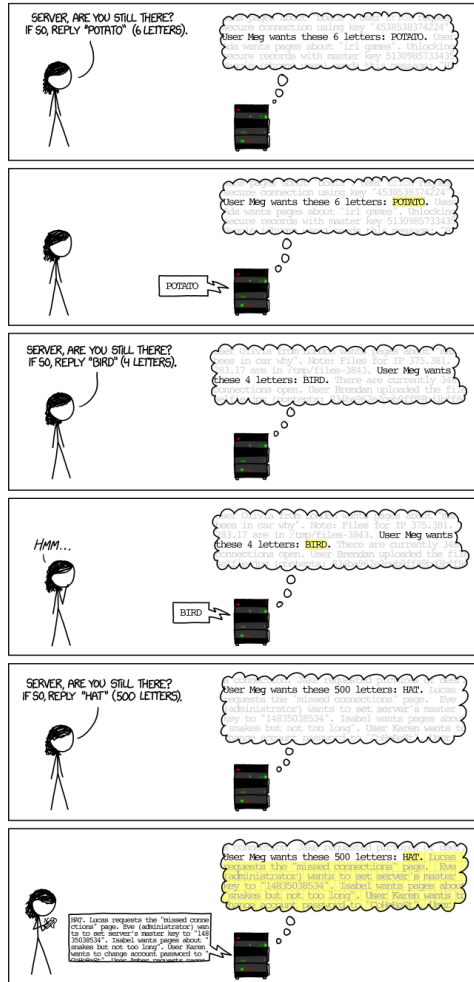
their passwords may have been compromised). Users can check whether a given website is vulnerable via a Heartbleed test also available as open source. The LastPass Heartbleed diagnostic also indicates whether the signature on the TLS key predates the publication of the Heartbleed vulnerability.

The vulnerable commit was introduced Dec 31st, 2011, by Robin Seggelmann, the first co-author of the heartbeats RFC, and went live when OpenSSL version 1.0.1 was released on 2012-03-14 and the vulnerability was widely announced 2014-04-07.

# #1354: Heartbleed Explanation

April 11, 2014

## HOW THE HEARTBLEED BUG WORKS:



Are you still there, server? It's me, Margaret.

## Explanation

The Heartbleed bug was, at the time of publication of this comic, receiving a lot of news coverage recently and was also the topic of the previous comic 1353: Heartbleed. This comic explains how the bug may have been discovered and can be exploited to reveal a server's memory contents.

A Megan-like character named Margaret (or "Meg") sends heartbeat requests to the server, the server responds to the heartbeat request by returning the contents of the body of the request up to the number of letters requested. The first two requests are well formed, requesting exactly the number of characters in the request body. The server's memory is showing Meg's request with many other requests going on at the same time.

Meg then ponders this and tries to submit another request asking for "HAT" but requests that it be 500 letters long instead of only 3; the server—not checking it or simply unaware that 500 letters is larger than the request body—returns "HAT" plus 497 letters that happened to be next to the word "HAT" in its memory (more will follow than are shown in the server's speech bubble as there are only 251 letters/symbols in the shown reply). Included are many sensitive bits of information, including a master key and user passwords. One of the passwords shown is "CoHoBaSt", a reference to 936: Password Strength, which suggests using "correct horse

battery staple" as a password.

Often popular explanations of security bugs require the issue to be simplified a lot and to leave out a lot of details. In this case Randall didn't have to do much simplifying; the bug is actually that simple. Also, any client that can connect to the server can typically exploit this bug in the underlying OpenSSL software — the use of the term "User Meg" does not imply that Meg had to authenticate first.

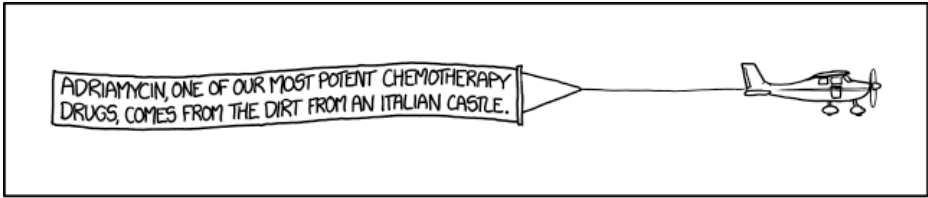
Although Randall shows Meg recording the data by hand, on paper, it is more likely that a person exploiting the bug would have a computer record the data, perhaps on its hard drive or on a flash drive. However one could argue that such a person would not communicate to the server by speaking out loud either.

The title text is a reference to *Are You There God? It's Me, Margaret.*, a novel by Judy Blume, and plays off of the "server, are you still there?" line in every panel where she did start a request. The novel is the theme of another comic 1544: Margaret too. Meg can be a nickname for Margaret as well as Megan who Margaret resembles.



## #1355: Airplane Message

*April 14, 2014*



### MY HOBBY:

BREAKING INTO AIRPLANE HANGARS AND REPLACING  
THE ADS ON THEIR GIANT BANNERS WITH COOL FACTS

PHARAOH IRY-HOR, FROM THE 3100s BC, IS THE FIRST  
HUMAN WHOSE NAME WE KNOW.

## Explanation

Large banners are sometimes flown behind airplanes to advertise a product or event to a large number of people. Here, Randall suggests replacing the ad with some interesting facts. This would tell people who see the banner something new and interesting about the world, rather than try to sell them something. He presents two possible facts: Adriamycin, a cancer therapy, and Iry-Hor, the earliest human we know by name.

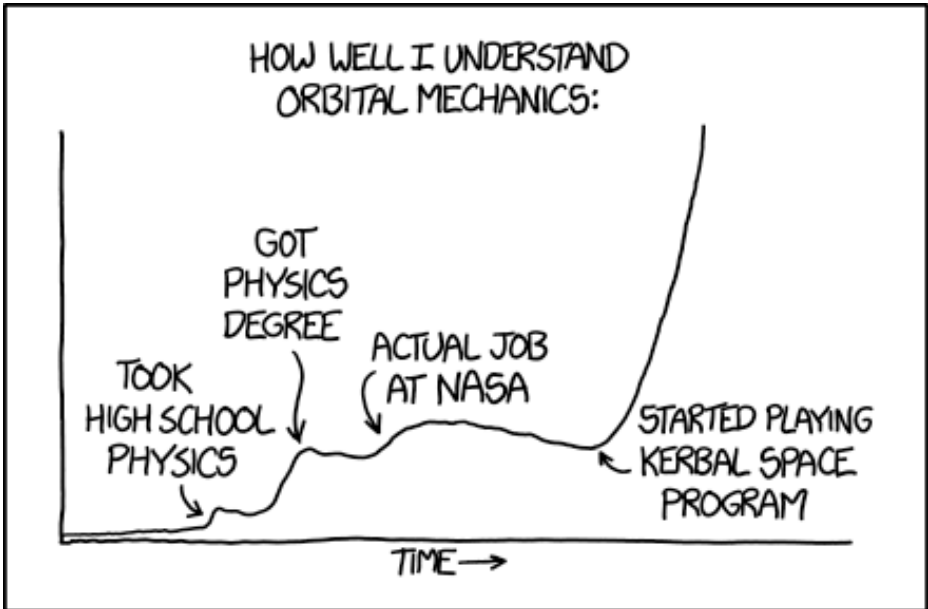
The chemotherapy drug doxorubicin, trade name Adriamycin, is based on a strain of the bacterium *Streptomyces peucetius*, first isolated from a soil sample taken at Castel del Monte in Andria, Italy.

As mentioned at the title text Iry-Hor was an ancient, predynastic pharaoh of ancient Egypt — no earlier documents exist today. Kushim is a contemporary contender.

This fact is also found in 1732: Earth Temperature Timeline, where it is placed at exactly 3100 BC (or BCE).

## #1356: Orbital Mechanics

*April 16, 2014*



To be fair, my job at **NASA** was working on robots and didn't actually involve any orbital mechanics. The small positive slope over that period is because it turns out that if you hang around at **NASA**, you get in a lot of conversations about space.

## Explanation

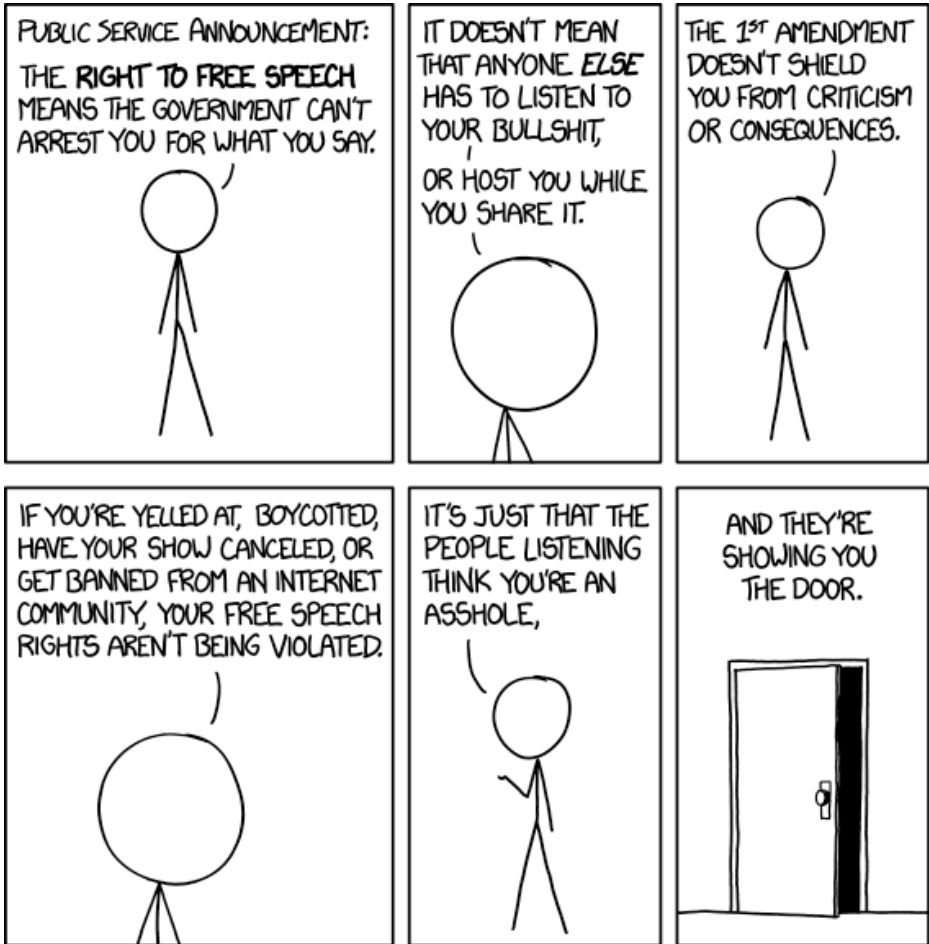
Randall roughly plots how high school physics, undergraduate-level physics and a job at NASA somewhat increased his knowledge of orbital mechanics. But this learning was apparently nothing compared to the "direct" experience of playing Kerbal Space Program, a rocket building and piloting sandbox game.

Orbital mechanics can be somewhat counterintuitive. The art of changing orbits involves relative velocities, positions, and times in complex interactions. As soon as you try deviating from a perfectly regular orbit, or start having to deal with N-body problems and orbital resonances, you have to coordinate your movements in possibly counterintuitive ways. One example is that if you want to reach an object ahead of you, on the same orbit, you actually have to 'brake' to reach a lower orbit. Once at that lower orbit, your angular velocity is faster, and you can start to overtake your target. After that manoeuver, you then have to accelerate to increase your orbital altitude again, which will end up reducing your angular speed so that you intercept your target.

At the title text Randall admits that at the time when he did work at NASA he was not involved in orbital mechanics—which is also true for most other NASA employees—but everybody was talking about this which in the end did increase his knowledge a little, as can be seen in the curve after the Job at NASA arrow.

## #1357: Free Speech

April 18, 2014



I can't remember where I heard this, but someone once said that defending a position by citing free speech is sort of the ultimate concession; you're saying that the most compelling thing you can say for your position is that it's not literally illegal to express.

## Explanation

Both on the Internet and in the physical world, people with unpopular or poorly thought-out opinions may complain that their freedom of speech is being restricted because others express their distaste for those opinions. As a defense, these individuals may invoke the First Amendment to the United States Constitution, which provides, among other things, freedom of speech for any entity or person under the legal jurisdiction of the U.S. More specifically, it states that "Congress shall make no law [...] abridging the freedom of speech, or of the press". Originally intended as a restriction on the powers of the U.S. federal government, which the Constitution defines, structures, and delimits, over time the First Amendment, as well as several others, were "incorporated" via the Fourteenth Amendment to apply to state and local governments as well. This protection of free speech, however, does not extend to illegal activities (for example, the concept of a "clear and present danger"), and it does not compel others to listen to or acknowledge the speech. The intended targets of the speech may simply choose to stop listening or to speak louder in protest.

An example of this is the incident involving the TV program *Duck Dynasty* in December 2013, in which television network A+E Networks suspended the host after he made homophobic remarks, causing some to comment that his rights had been infringed upon. Similarly in April 2014 controversy erupted when

Brendan Eich was forced to resign as CEO of Mozilla because it was revealed he had donated money to anti gay-marriage efforts in California. In actuality, the First Amendment was never meant to provide immunity from any consequences.

Cueball, representing Randall, is addressing those who use the freedom of speech argument as a defense against societal censorship. He states that one's legal right to take a stance on an issue does not require others to listen to said stance. In addition, he also states that this right does not require a commercial or social entity — such as a TV network, a website, or its community — to support a person in spreading their message, even if it had supported you in the past. If someone says something that others find unjustified or offensive, they should be ready to accept the consequences of others' responses.

The title text points out that regardless of how free speech works, anyone appealing to it as a defense for their argument or opinion is not persuasive in any case. If the only thing that someone can say in support of an argument is effectively that it is not illegal, then they are severely undermining it by essentially admitting that they don't have any better defense for it.

It should be noted that the first panel of this comic conflates, under certain schools of thought about justice and rights, a right such as free speech and the legal protections of such. Many viewpoints consider rights to be granted by the government; others consider rights to be innate regardless of what the government does. The

former is frequently reflected throughout governments in Europe while the latter is more common throughout the Americas. According to the former, the first panel is technically correct by definition, because the right of free speech is granted by the government's laws and, as such, can only affect the government's influence: thus, the 1st Amendment grants the right to free speech, which by definition cannot be restricted by congress. According to the latter, the first panel is strictly nonfactual because the 1st Amendment only recognizes that the right of free speech exists and, rather than delimiting the right, it instead proscribes the government's actions. However, between these two schools of thought, the remaining panels aren't affected by whether or not the first panel is factual by definition.



#1358: NRO

*April 21, 2014*



THE NATIONAL RECONNAISSANCE OFFICE HAS  
AN UNUSUAL APPROACH TO *WHERE'S WALDO*.

'DISPATCHING DRONE TO TARGET COORDINATES.' 'Wait,  
crap, wrong button. Oh jeez.'

## Explanation

Where's Waldo? (the North American renaming of the British Where's Wally?) is a children's puzzle book in which you have to locate 'Waldo', a character with a distinctive striped shirt and hat, in a picture crowded with hundreds of characters. This is harder than it sounds, since the characters and other distractions are both very small and quite densely packed on the page, and the pages (especially in later books) are often littered with "decoy" characters wearing similar articles of clothing to Waldo's. In some cases, almost all characters as well as several objects have the red-and-white stripes.

Cueball and his friend are using satellite imaging to find Waldo, by holding the book up to the sky and viewing it on the computer, presumably using some advanced image processing software to identify Waldo among the crowd. This would require a very advanced camera, as resolutions are usually much lower than would be necessary to resolve the characters in a Where's Waldo book. But since Cueball works at the National Reconnaissance Office (NRO), the US government agency responsible for operating spy satellites, he probably has access to some powerful satellite/UAV-mounted cameras.

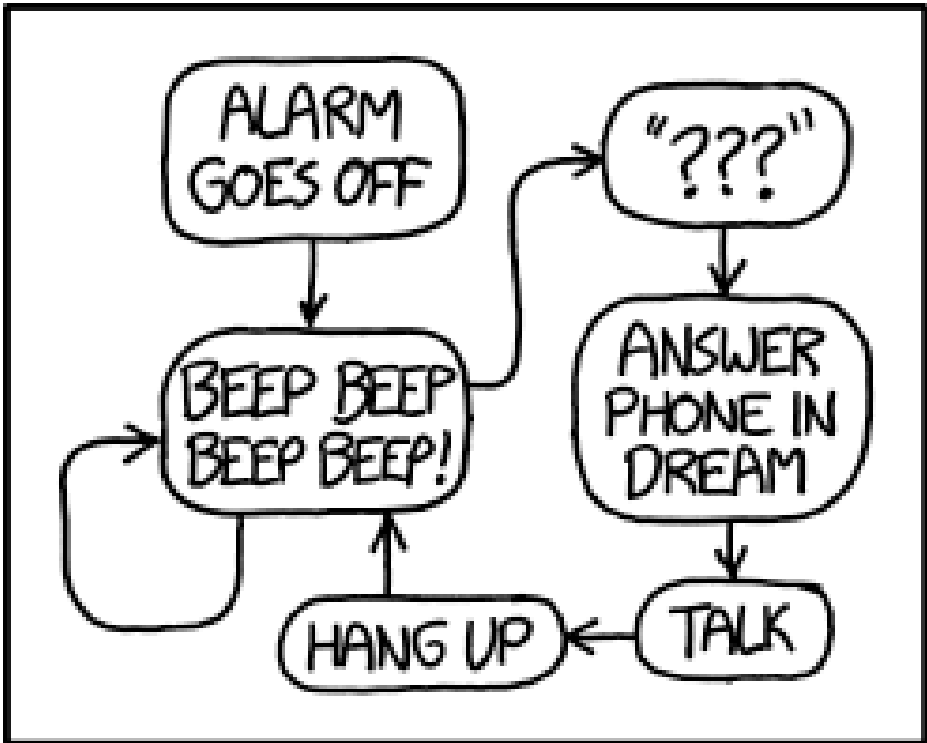
The humor in this being, while he could be using that power for much more important things, he's instead trying to solve a simple game. Further, the Cueballs could probably hook up the image parsing software to a

smaller camera on the ground, rather than a satellite-mounted camera. They would get even better results without using a camera by scanning the image and running it through the same image processing software.

The title text is implying that the Cueball operating the computer has accidentally launched a drone at the co-ordinates, which would be where he and his friend are standing. The drone is presumably a military drone armed with explosive weaponry — not a good thing for those on the receiving end.

## #1359: Phone Alarm

*April 23, 2014*



## MY PROBLEM WITH PHONE ALARMS

Who's calling me?? WHY IS THE WORST PERSON IN THE WORLD CALLING ME!?

## Explanation

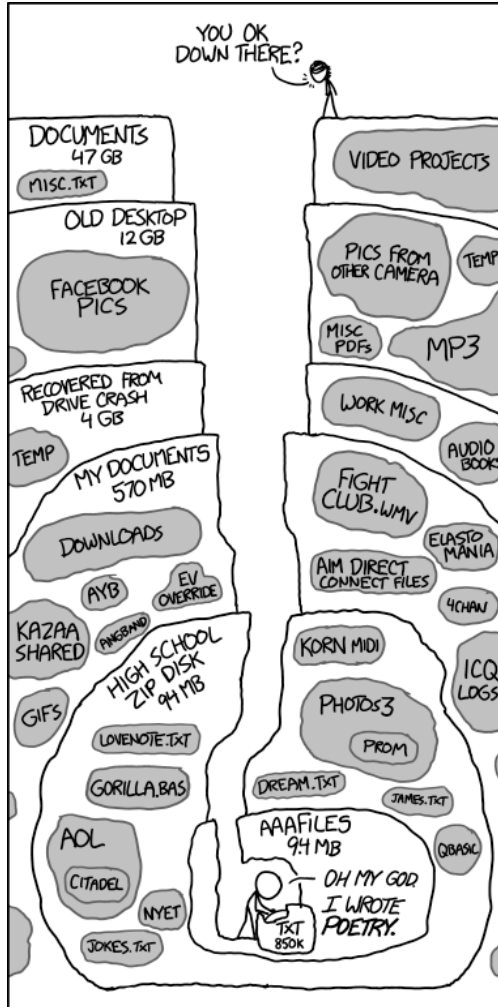
The flowchart shows a problem Randall has with using alarms built into phones. Notably, that the sound is similar to a normal ring tone (probably related to 479: Tones), making it sound like someone is calling him, and not waking him up. This results in him having a false awakening, where he dreams about answering the phone, talking, and eventually hanging up. Of course this doesn't stop the actual phone from ringing, and he ends up answering the phone again. The looping arrow around the "beep beep" box implies that the phone keeps ringing only until he attempts to answer it, which would be quite a coincidence. This is an example of an endless loop, where there is no given way for the flowchart to end, just as in 1195: Flowchart. Now, smartphones typically support customization of tones for different apps so that your alarm doesn't have to sound like your ringtone and many apps load their own distinctive tone now by default.

The title text, consisting of Randall shouting at the phone in his dream, enforces the fact that he can't tell between his ringtone and his alarm. In doing so he believes that a prank caller is harassing him which infuriates him. Alternatively, "the worst person in the world" could just refer to the confused logic in dreams, where a caller could, inexplicably yet unquestionably, be the worst person in the world.

A list of all the flowchart comics can be found [here](#).

## #1360: Old Files

*April 25, 2014*



Wow, ANIMORPHS-NOVEL.RTF? Just gonna, uh, go through and delete that from all my archives real quick.

## Explanation

This comic came out the day after Sky News published the story of original Andy Warhol artwork, created in 1985 on an Amiga 1000, which was recovered from recently found floppy disks.

Cueball is shown literally digging through a pile of old files; which is a metaphor for looking through old files on his computer. The layers of the pile are arranged much like geological rock formations where older strata are deeper down than younger layers. The files are in concentric layers because each directory is embedded in the previous directory. Therefore, the "Documents" folder contains an "Old Desktop" folder, which contains a folder with files recovered from an older system, which itself contains a "My Documents" folder, which contains a folder with files copied from a Zip Disk from high school. The result is that files from high school have survived in his present-day machine. These older folders serve as a time capsule of sorts, storing old files from AOL, NYET, and Kazaa. These files are meant to be analogous to the fossils and artifacts found in lower, older rock layers.

The sizes of the files decrease as Cueball goes deeper, since data storage has gotten cheaper over time. When the Zip Drive first came out, it cost \$200 USD (plus \$20 per 100 MB floppy). As of 2019, \$200 could buy you at least an 8 TB portable external hard drive. In the 1990s, during AOL's heyday, 10+ GB hard drives were

prohibitively expensive and a terabyte of data was unimaginable to most users.

Deep down, Cueball discovers several files he is surprised about, including a poetry file which embarrasses him as he does not remember writing poetry.

In the title text, he mentions also finding an "Animorphs Novel", which may be a text copy of one of the original books or a fan fiction of the Animorphs series (his reaction of quickly eradicating it may either be to prevent him being caught with a presumably-illegal copy of an Animorphs book or as a result of embarrassment at his fan fiction - the former is less likely than the latter considering some of the other files mentioned, so it is most likely a fan fiction). The series was released between 1996 and 2001, consistent with the fact that these files were created during Cueball/Randall's high school years. The series was extremely popular at the time. Animorphs has already been mentioned in the title text of 1187: Aspect Ratio, and later it was the main joke in 1380: Manual for Civilization and 1817: Incognito Mode.

## **Files and Folders[edit]**

The folders and files in detail:

Documents (47 GB): A large folder containing many of Cueball's personal files.

- misc.txt: A miscellaneous text file, which could contain anything; possibly just various notes that Cueball is keeping.
- Video projects: As video files can take up a lot of space and



video projects tend to use a lot of them, this likely makes up a considerable portion of the 47 GB.

Old desktop (12 GB): A backup from a former computer.

- Facebook pics: Pictures that were intended to be added to Facebook (and/or ones which were downloaded \*from\* Facebook).
- Pics from other camera: Unknown pictures from a second camera.
- Temp: Temporary folders generally contain cached files and files that are used temporarily to install programs. A folder named "Temp" might also be created by a user to store unimportant text or image files, not intending or caring to give it a more meaningful or specifically explanatory name.
- Misc PDFs: PDFs are often used for documentation, but could be any collection of digitized books or other documents.
- MP3: MP3 is a widely used format for digital audio files.

Recovered from drive crash (4 GB): When a hard drive crashes, some or all data may be recovered.

- Temp: Temporary files.
- Work misc: Unknown work related projects.
- Audio books: Recordings of books being read out loud.

My Documents (570 MB): Windows XP user accounts came with a "My Documents" folder that was widely used for storing personal files. The items in this archive came from the era when Windows XP was popular.

- Downloads: The default download folder for most browsers of the time.
- Kazaa shared: Kazaa is a defunct peer-to-peer file sharing program. The "shared" folder is shared with other members.
- AYW: ALL YOUR BASE are belong to us is an internet meme inspired by a bad translation from Zero Wing. Also referenced in 286: All Your Base.
- EV Override: An Apple Macintosh video game, released in 1998.
- Angband: A game named after a fictional stronghold created by J. R. R. Tolkien.
- GIFs: An image format widely used for transparent or animated images.
- Fight Club.wmv: A movie. As feature movies are typically compressed to 700 megabytes, and this folder only contains 570 MB in its entirety, including 94 MB explicitly in a further sub-folder, this one file must be significantly smaller. It could be of very low quality (e.g. resolution and/or frame-rate), truncated (after a prior failed copy) or even a fake download designed to fool unwary recipients.
- Elasto Mania: A physics-simulation game that claims to show real physics.
- AIM Direct Connect files: Files transferred via AOL Instant Messenger.
- 4chan: An image-board where users can upload pictures anonymously. Randall impulsively saves pictures from there. This entry is something of an anomaly, the rest of the files at this level were most notable around 1998 to 2001 while 4chan was

only launched at the end of 2003. Since this board frequently contains images you wouldn't want to be caught looking at, this folder may be buried to hide it.

- ICQ logs: Logs from a now-defunct instant messaging program introduced in 1996.

High school Zip disk (94 MB): The most popular form of superfloppy, introduced in 1994 with a capacity of 100 MB.

- Korn MIDI: Korn is an American nu metal band formed in 1993. MIDI is a protocol for communication with electronic musical instruments. The result tends to be sounds of low quality (but it heavily depends on how MIDI is played).
- Photos3: This is a folder of old photos.

Prom: Pictures taken at prom.

- lovenote.txt: An old text file of a love letter, probably to a classmate in high school. Possibly referencing 340: Fight.
- Gorilla.bas: A game written in BASIC, to be run on QBasic, and supplied with MS-DOS.
- Dream.txt: Some private dreams. Possibly a reference to 269: TCMP.
- James.txt: This may be James Zetlen, one of Randall's friends.
- AOL: An early online and internet service, founded in 1985 and popular in the 1990s.

Citadel - A BBS and email platform that was widely used in the 1980s and early '90s.

- QBasic: An IDE released by Microsoft in 1991, which was used

to write and run computer programs in the BASIC language.

- NYET: NYET was a Tetris-like game for MS-DOS, released in 1988.
- Jokes.txt: An old text file of jokes.

AAAFILES (9.4 MB): Some of Cueball's oldest documents, likely prefixed with "AAA" to put the folder at the top of an alphabetically-sorted list.

TXT (850 K): Old text files, which include poetry he didn't remember writing.

## #1361: Google Announcement

*April 28, 2014*



The less popular 8.8.4.4 is slated for discontinuation.

## Explanation

At the time of this comic's release, Vic Gundotra had recently left Google. Because he was the head of Google+, this had caused many people, including TechCrunch, to theorize that Google+ was going to be shut down, despite the continuing comments from Google that it would remain active and updated. It lasted five more years, finally being closed on April 2nd, 2019.

Google has a history of closing popular services.

The comic extrapolates this to an announcement that Google would be closing all its popular services, up to and including its e-mail service, Gmail, and even the core business of the company, its Internet search engine, to wholly concentrate on a relatively obscure part of its product lineup. According to Google, its Public DNS servers (Domain Name System servers), better known by their IPv4 addresses 8.8.8.8 and 8.8.4.4, are supposed to be a faster alternative to using one's ISP's DNS servers (because of caching effects due to a large user base), as well as less susceptible to censorship. When Turkey started blocking access to Twitter and YouTube in March 2014, Turkish ISPs first did this on the DNS level by manipulating the results from their own name servers. The most popular workaround was using Google's DNS server instead, so much so that its address was written as graffiti on the side of a building.

The joke may also be related to the fact that 8.8.8.8 is an

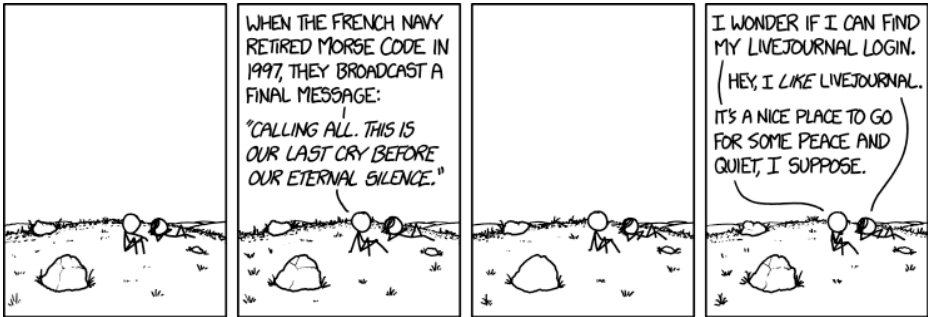
IP address heavily used by network administrators to perform connectivity tests (ping) because it is easy to remember and fast to type. Google would want to concentrate on this feature to build a business model using that fact.

The reason behind this decision may be that Google considers a DNS server, a fairly low-level component of the Internet's service stack, to be the optimal place to collect information on its users, an accusation leveled at Google ever since it introduced the service.

The title text refers to the impression held by some that Google will shut down services that prove less popular than desired at short notice, even though they may in fact have a significant user base. For instance, Google's closure of the RSS aggregation service, Google Reader, in July 2013. While the same DNS service is provided under both addresses, the more memorable 8.8.8.8 is likely to receive far more requests than 8.8.4.4.

## #1362: Morse Code

*April 30, 2014*



Oh, because Facebook has worked out **SO WELL** for everyone.



## Explanation

Cueball recounts the last message sent in morse code by the French maritime radio station Le Conquet radio upon retiring its 500 kHz channel.

The poetic, and potentially angsty-sounding nature of the message reminds him of the on-line journal website LiveJournal, which was popular until the late 2000s (it was launched in 1999), and stereotypically used by angst-ridden teenagers to post song lyrics, poems, or cryptic messages to express their emotions and possibly fish for attention. Since Cueball never uses his LiveJournal account any more, he wonders if he can find the password again. He might be considering posting the final Morse Code message as his own last and final message on his LiveJournal.

The popularity of the site died down considerably with the arrival of social networking sites like MySpace, Facebook, Google Plus and the advent of microblogging platforms like Twitter and Tumblr. LiveJournal has also lost a lot of users since a Russian company bought them out; Russian dissidents used LiveJournal to present their opinions, and the Russian government used to retaliate by creating "denial of service" attacks which make LiveJournal unusable for all its users, sometimes for days. Nowadays (May 2014) LiveJournal is still quite popular among Russian-speaking people, including dissenters, but its administration was forced to show HTTP 451 error in some cases (e. g., when a user with a Russian IP is

trying to read Alexei Navalny blog) with new laws. Thus when Megan is upset with his desire to let LiveJournal die out like the Morse Code, Cueball describes it as "a nice place to go for some peace and quiet".

The title text is Megan's (or Randall's) sarcastic remark indicating that Facebook is no less filled with angst-ridden thoughts than LiveJournal was, nor is it free from problems or controversies around other issues such as security or privacy.

## #1363: xkcd Phone

May 02, 2014



Presented in partnership with Qualcomm, Craigslist, Whirlpool, Hostess, LifeStyles, and the US Chamber of Commerce. Manufactured on equipment which also processes peanuts. Price includes 2-year Knicks

contract. Phone may extinguish nearby birthday candles. If phone ships with Siri, return immediately; do not speak to her and ignore any instructions she gives. Do not remove lead casing. Phone may attract/trap insects; this is normal. Volume adjustable (requires root). If you experience sudden tingling, nausea, or vomiting, perform a factory reset immediately. Do not submerge in water; phone will drown. Exterior may be frictionless. Prolonged use can cause mood swings, short-term memory loss, and seizures. Avert eyes while replacing battery. Under certain circumstances, wireless transmitter may control God.

## Explanation

This comic is a parody of a multitude of mobile-technology related issues that, when brought together, create a general satire of smartphone advertising. It was the first entry in the ongoing xkcd Phone series with the next 1465: xkcd Phone 2 released about nine months later. The advertised features here either make previously useful capabilities useless or add features nobody wants.

The phone's tagline, "Your mobile world just went digital", is purposefully outdated. It references a time when cell phones transitioned from analog to digital technology, which happened many years before the comic's publication. By marketing the xkcd Phone as "going digital," the implication is that it's a groundbreaking advancement, integrating computers and the internet into a market that has always involved these elements. However, the mobile phone market had already been digital for a long time, making the marketing of the xkcd phone seem dated and clueless.

### Phone features[edit]

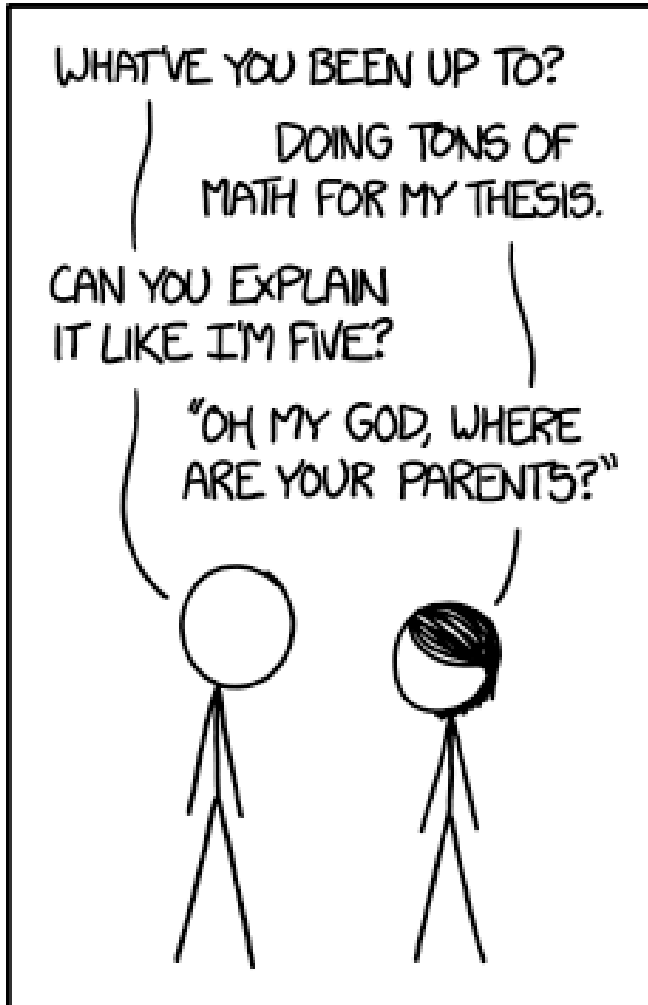
From the top, going clockwise:

### Title text[edit]

The ominous warnings and disclaimers in the title text are probably a reference to the Saturday Night Live parody ad for Happy Fun Ball (watch on YouTube).

**#1364: Like I'm Five**

*May 05, 2014*



'Am I taking care of you? I have a thesis to write!' 'My parents are at their house; you visited last--' 'No, no, explain like you're five.'

## Explanation

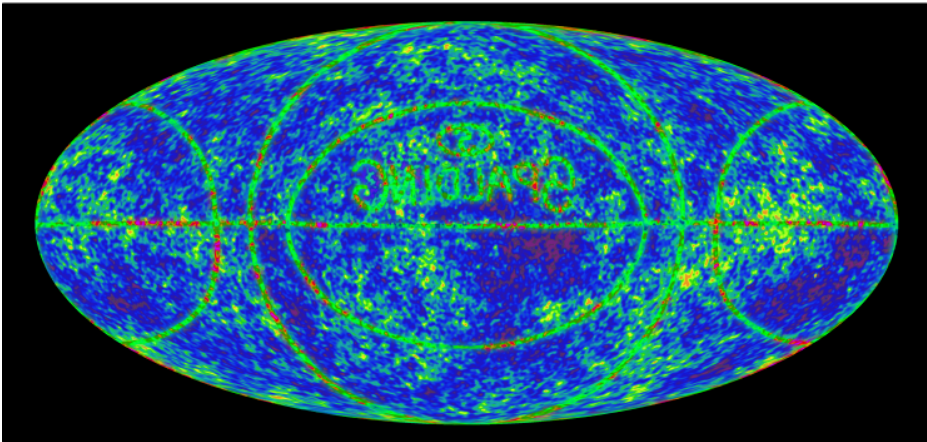
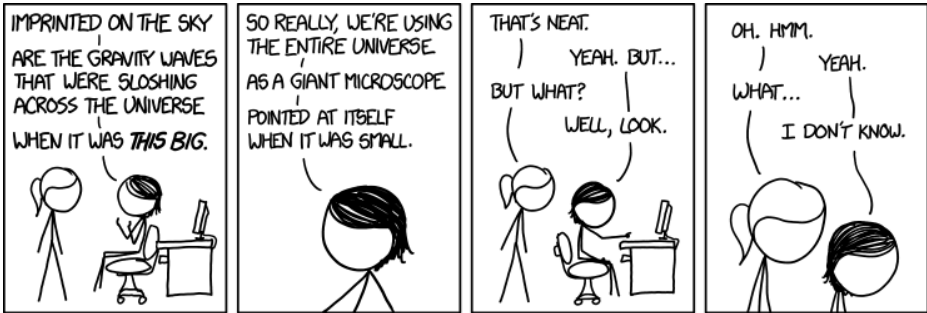
Megan tells Cueball that she is working on her math thesis. A thesis consists of original research and generally deals with material that is difficult for the uninitiated to understand. Cueball anticipates that it will be difficult to understand, and asks her to "explain it like I'm five". "Explain it like I'm five" is a way of asking for a simpler explanation of some difficult topic, in a way that a five-year-old child would be able to understand. Megan sarcastically (or perhaps not) treats Cueball as if he is an actual 5-year-old without his parents, expressing her concern that a 5-year-old is without any supervision. This is an example of idiomatic language being taken literally, something that Randall has explored in other comics as well, such as 1454: Done, Shake That, and Reverse Euphemisms.

In the title text, Megan feigns concern that she will have to abandon her work to take care of this supposed lost child and takes this role-playing further by refusing to respond to Cueball until he phrases his comments as a 5-year-old would.

The common expression "Explain it like I'm five" is inspired by a line by Groucho Marx in his movie *Duck Soup*. "Why a four-year-old child could understand this report! Run out and find me a four-year-old child, I can't make head or tail of it."

## #1365: Inflation

May 07, 2014



Wait till they notice the faint reflection of Michael Jordan and Bugs Bunny in the E-mode.



## Explanation

The comic is inspired by the now disproven BICEP2 discovery of gravitational waves from the early universe, hence providing evidence for the cosmic inflation hypothesis. Megan is excited about this and tells Ponytail all about it. She is impressed by the fact that these waves were created when the universe was extremely small and the expanding universe has "imprinted" the gravity waves. (See also 1642: Gravitational Waves).

She compares this to the nature of a microscope - which optically expands a small image, just like the universe has done to itself. Ponytail is impressed by it until Megan looks at the image captured by the Wilkinson Microwave Anisotropy Probe (WMAP).

The concept of an expanding universe is sometimes explained by the "balloon model", where the two-dimensional skin represents our three-dimensional universe and the inflation of the balloon represents expansion over time. But instead of showing a balloon, Randall uses a basketball, which cannot inflate as easily as a balloon.

The elliptical Mollweide projection of this cosmic microwave background (CMB) image of the sky makes the map look a bit like a basketball. Randall further exaggerates this by superimposing the traditional curves that are visible on a basketball and the Spalding company logo over the original image available at the bottom here.

The mentions of scale and basketballs in this comic might be a reference to the "If the Earth were the size of a basketball" comparison, similarly to 1074: Moon Landing and 1515: Basketball Earth.

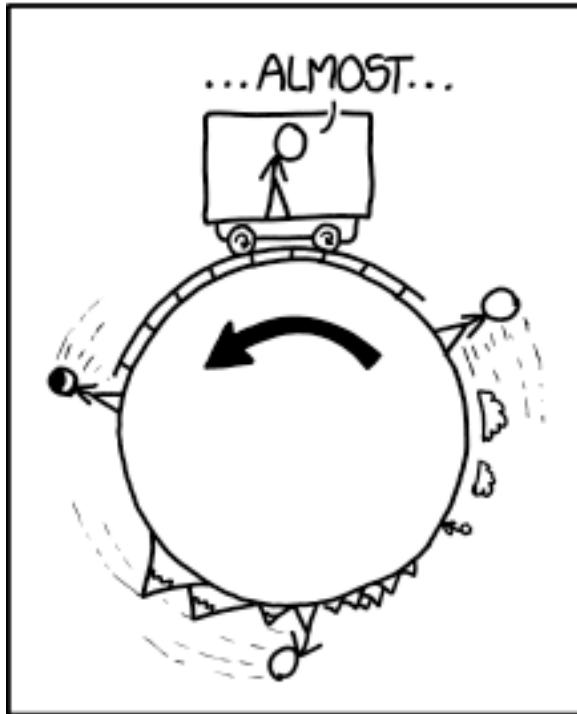
Megan and Ponytail are both disconcerted by this, and the title text references the 1996 basketball movie Space Jam by promising images of main characters Michael Jordan and Bugs Bunny if the polarization of the view is changed to E-mode, a type of polarization of the cosmic background radiation arising from the radiation scattering off non-uniform plasma.

The image was updated between 7 AM and 8:30 AM EST on May 7. Originally the Spalding logo was shown from left-to-right; however, in the updated image, the Spalding logo is shown in reverse. The WMAP image has the correct orientation in both versions. This was likely due to a mistake on Randall's part, as the comic suggests the universe is contained inside a Spalding basketball. Seen from the inside, the Spalding logo would be shown in reverse, as seen in the updated image. The first image can be found [here](#). Both the original and updated version don't exactly match the pattern on a typical basketball. Most basketballs are divided into eight identical (ignoring reflection) pieces in a pattern that allowed traditional leather basketballs to be made from a single template, while the image shows a pattern that would split a basketball into two types of pieces.

## #1366: Train

May 09, 2014

### TRAIN:



A MACHINE THAT GRABS THE  
EARTH BY METAL RAILS AND  
ROTATES IT UNTIL THE PART  
YOU WANT IS NEAR YOU

Trains rotate the Earth around various axes while  
elevators shift its position in space.

## Explanation

This comic, which appeared the day before National Train Day, plays on the fact that a choice of a reference frame is arbitrary, leading to the "Principle of relativity" in Albert Einstein's theories of special relativity and general relativity. But at speeds much lower than the speed of light it also applies to Newtonian mechanics.

Rather than viewing this situation as a train causing itself to move relative to an immobile Earth, Randall provides the unconventional perspective of a train remaining fixed in space while causing the Earth itself and all the stars in the sky to rotate instead. In principle either perspective is equally valid — though in practice different trains often move in mutually-exclusive directions, thus each train would have to define its own frame of reference. It is said that Einstein once asked a ticket collector, "What time does Oxford stop at this train?"

From the Newtonian perspective this choice of frame is valid, but results in unnecessarily complicated math; the equation of motion would include terms for centrifugal, Coriolis and other so-called "fictitious forces" (see 123: Centrifugal Force). Newton supposes the existence of "inertial frames", in which these forces are zero, and the surface of the Earth approximates an inertial frame well. In General Relativity, the presence of mass in a system curves the spacetime around of it. The train-earth system could be modeled in general relativity, taking the train as fixed. However the resulting equations would be

complex, and not amenable to an exact solution.

The title text expands on this to include elevators, which change a person's position relative to the center of the Earth. From a passenger's perspective, it would appear as though the Earth's position was instead being changed in space.

These examples use the train and the elevator as fixed points to define relative travel. The more common method to define movement is to use the Earth's surface as fixed point, but other reference points could be the Earth's center, the Sun, predefined "fixed" stars or the center of our galaxy. Each of these would result in a completely different movement speed:

- The speed of the train (stationary on the equator) relative to the earth's center: 465 m/s (1,674 km/h or 1,040 mph)
- The speed of the train (on earth) relative to the sun: 30 km/s (108,000 km/h or 67,000 mph)
- The speed of the train (on earth) relative the center of our galaxy: 220 km/s (828,000 km/h or 514,000 mph)

The train, as seen from an inertial frame, doesn't seem to rotate the earth, but it does in fact have a minute, immeasurable effect on the Earth's rotation (see what-if? 41: Go West and 162: Angular Momentum).

## #1367: Installing

May 12, 2014



I FELT PRETTY CLEVER UNTIL I  
REALIZED I'D INVENTED WEBPAGES.

But still, my scheme for creating and saving user config files and data locally to preserve them across reinstalls might be useful for--wait, that's cookies.

## Explanation

This comic refers to the kind of "inventions" which seem new from the point of view of a smartphone user but have already been around for a long time on desktop or laptop/notebook computers.

Cueball has a clever idea to skip the installing of applications on mobile phones: he would host the applications online instead and provide links to the servers. The apps wouldn't stay on the phone all the time; instead, the phone would download each app again every time the user wanted to run it.

However, web pages and web applications already work like this. Clicking a link will make the browser download a web page and render HTML code and JavaScript that it links to.

The page usually isn't saved long-term on the user's computer; instead, the browser downloads it again when needed. HTML5 does however offer the option of caching web application files locally so it can remain operational when there is no network connection.

In the title text, Cueball's idea for local application storage already exists in the HTTP protocol as cookies. The more flexible web storage was originally part of the HTML5 specification, but it's now in a separate specification.

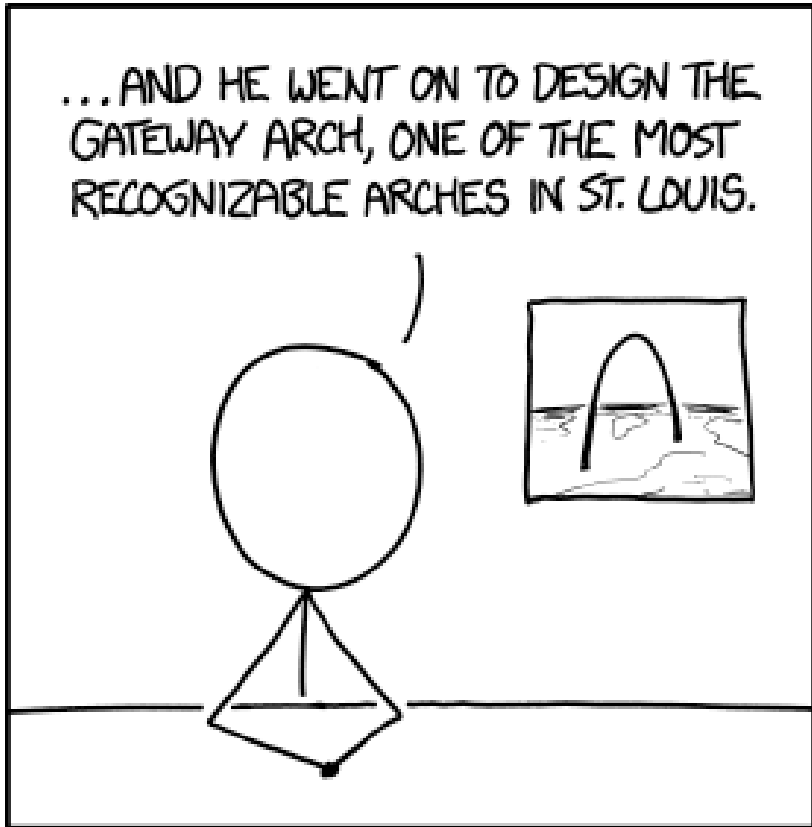
Native phone applications and web applications are not

completely interchangeable. Web applications may not allow access to more advanced or platform-specific resources. Projects like Apache Cordova make these resources available to web applications by creating a native application wrapper for the web application.



#1368: One Of The

May 14, 2014



PET PEEVE:  
REPORTERS UNNECESSARILY  
HEDGING WITH "ONE OF THE"

'The world's greatest [whatever]' is subjective, but 'One of the world's greatest [whatever]'s' is clearly objective. Anyway, that's why I got you this 'one of the world's greatest moms' mug!

## Explanation

Another of Randall's many Pet Peeves, this time on reporters.

Cueball is a news anchor describing the Gateway Arch as one of the most recognizable arches in St. Louis. In this case the designer the reporter is likely referring to is Eero Saarinen.

When describing things, reporters try to make only factual statements. If reporters use absolutes (that something is the largest or the smallest thing of its class, or that it is unprecedented, to give several examples) they risk making errors: it is possible that some other example of the thing exists that is even larger or even smaller or that there was some similar incident in the past, and they were not aware of it. If a reader or viewer points out the existence of that thing, even if obscure or trivial, the reporter must issue a correction. As a result, reporters learn to hedge by using formulations such as "one of the biggest" or "a rare example of."

Randall states that it is his pet peeve when reporters avoid absolutes unnecessarily — that is, in cases where there's vanishingly little risk of error. As an absurd example, Randall depicts one such reporter using this language about the Gateway Arch. As one of the most well-known monuments in Missouri and one of the largest free-standing arches in the world, it's indisputable that this would be one of the most recognizable arches in

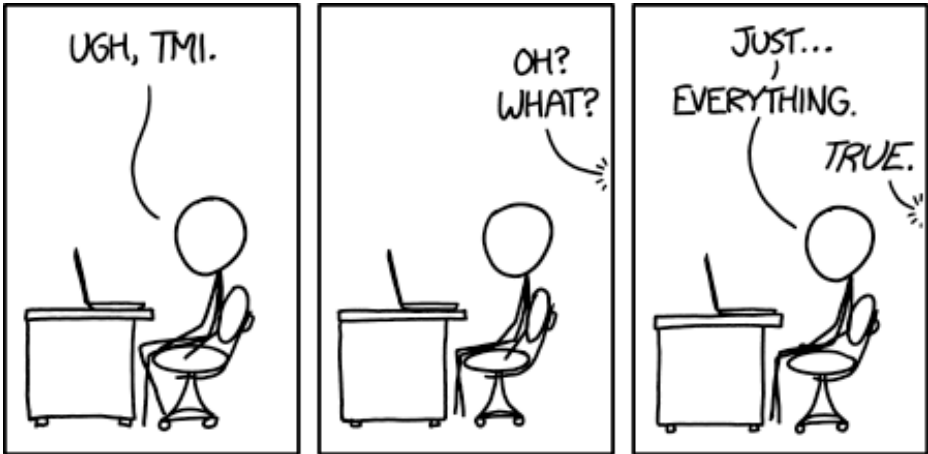
St. Louis; in fact, the reporter should be confident enough to say that the Gateway Arch is the most recognizable arch in St. Louis.

In the title text, Randall jokes about what could happen if you misunderstand the practice of avoiding absolutes; he thus appears to think it is an ostentatious display of faux objectivity, as opposed to a correction-avoiding strategy. The title text refers to novelty mugs (and T-shirts, and other printed items) that use superlative descriptions such as "World's Greatest Mom" or "World's Greatest Dad." Obviously, such a statement is an expression of personal affection on the part of the family member who gave such a gift and is not meant to be understood as a literally true fact about the world. Using a parody of reporter-speak (like giving a mug to your mother that says "one of the world's greatest moms") would ruin the compliment by suggesting to her that you thought some other people's moms were as good or better.

The title text also refers to Mother's Day, which in the US was three days before this comic was published.

# #1369: TMI

May 16, 2014



'TMI' he whispered, gazing into the sea.

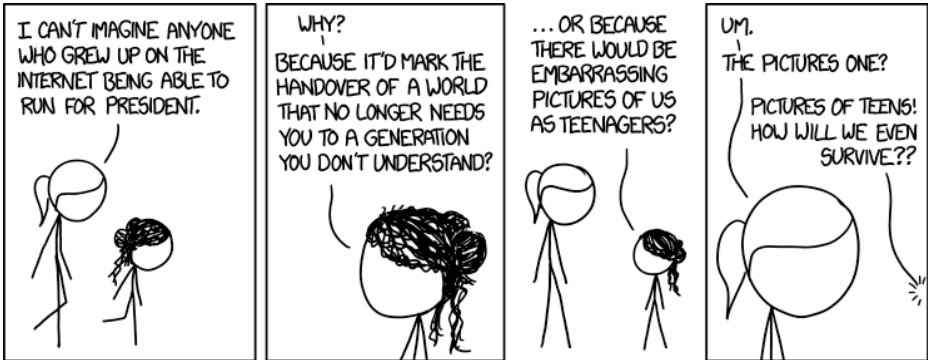
## Explanation

"TMI" is an acronym that means "too much information". It is typically used as a response to someone "oversharing" — telling personal details ("Sorry I just missed your call - I was urinating when the phone rang") that the listener would rather not have heard. Here, however, Cueball may be using it in a more literal and absolute sense: he feels overwhelmed by the colossal amount of information that is now generally available to anyone with an Internet connection.

The title text amplifies this interpretation by evoking the image of an individual person who is overcome as he stands at the edge of the ocean, contemplating its vastness.

## #1370: President

May 19, 2014



Anyone who thinks we're all going to spend the **2032** elections poring over rambling blog posts by teenagers has never tried to read a rambling blog post by a teenager.

## Explanation

This strip shows a discussion between Ponytail and Jill about an aspect of the future. Randall likes this setup, allowing to put in perspective the various "decay" predictions and shows his optimism.

Here, the subject is scandal. How will a generation that is documenting and leaving behind a permanent public record of its juvenile misadventures - immature and impolitic writings, photographs of inebriation at parties posted on Facebook, Twitter posts about breakups, etc. - produce successful future politicians? Won't future opposition researchers and reporters have enough embarrassing material to destroy any Millennial's public reputation? In previous generations, juveniles were freer to go through this phase of development without leaving behind a digital record, making it easier to sidestep or paper over rumors of youthful misbehavior. See, e.g., George W. Bush, who dismissed questions about his rumored use of drugs in his youth by saying only, "When I was young and irresponsible, I was young and irresponsible."

The child's answer, in addition to teasing the adult about her generation's coming obsolescence, is that the next generation will be fine because in the future no one will care. The title text amplifies this optimistic message, suggesting that old blog posts by former teenagers will just seem boring, not salacious. Randall offers no explanation for this upbeat spin, but it is a recurring

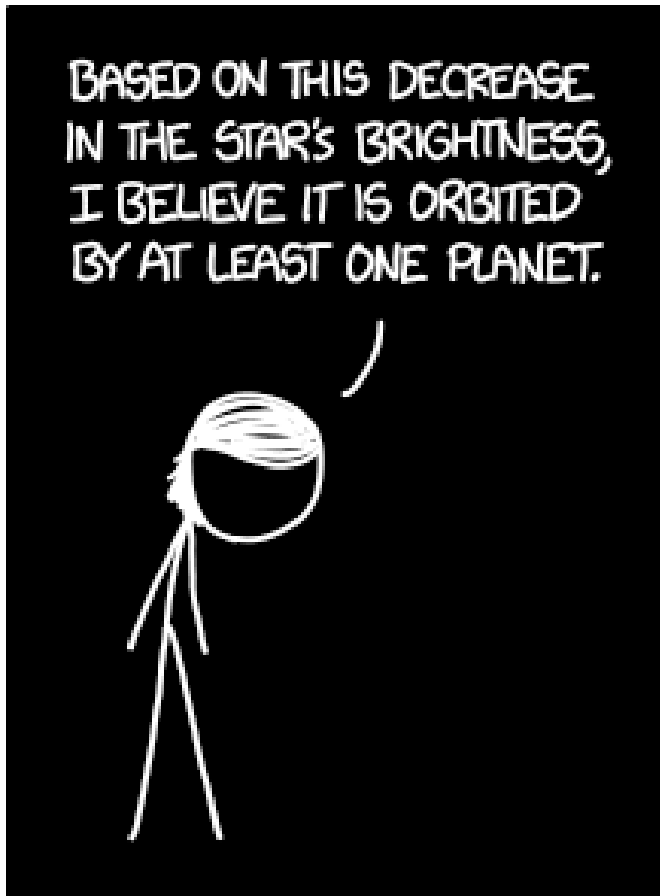
topic and some have argued elsewhere that the potential power of Internet-chronicled youthful indiscretions will be defused because everyone will be in the same boat, making future voters (and, in another context, employers) more tolerant of such things.

The strip also contains an existential twist, as shown in the child's answer. It alludes to every generation's dismissal of the next, as actually being due to psychological insecurities. We may disguise our dismissals by attacking their faults & different lifestyles. But in truth, these dismissals are actually rooted in our innate fear of becoming obsolete, useless, surpassed, and lost in a bewildering world that has passed us by.



## #1371: Brightness

*May 21, 2014*



### EXOPLANET ASTRONOMERS AT NIGHT

Recently, some exoplanet astronomers have managed to use careful analysis of reflected light to discover Earth during the day.

## Explanation

Exoplanets are planets outside of our solar system, and exoplanet astronomers are astronomers who attempt to discover and study such planets.

Megan is using a common exoplanet discovery technique to discover a planet around a nearby star. When a planet passes between an observing astronomer and a star, the planet will block some tiny part of the light coming from that star, causing it to appear dimmer for some amount of time. The Kepler telescope used this technique to find evidence for exoplanets.

But here Megan is standing on the surface of the Earth at night, looking at the ground, and therefore presumably looking in the direction of the sun. By observing that it is completely occluded at night, she correctly concludes that the Sun is orbited by at least one planet: the Earth. This is obviously an absurd usage of that method. Reasons include the fact that exoplanets are not big enough to block out all of their stars' light when seen from Earth,[citation needed] making what Megan says a massive understatement, and that the period of the brightness oscillations would correspond to the length of a day, not a year as it would for exoplanets.

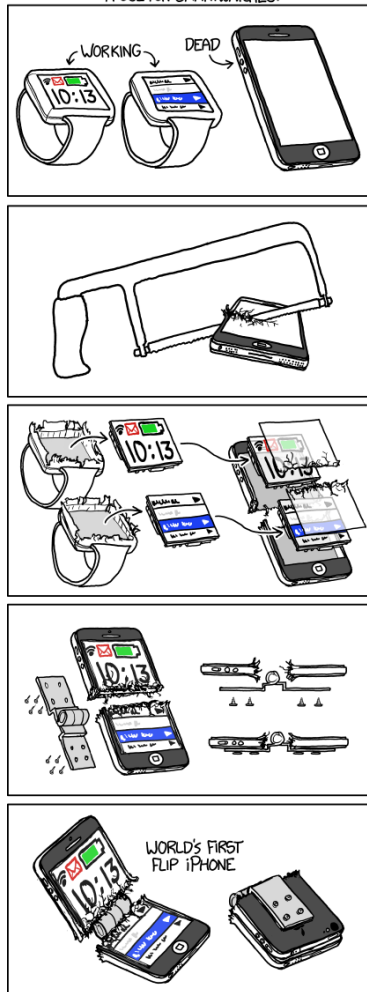
The title text alludes to using more complicated techniques to observe light reflected by small planets like the Earth, for example by detecting polarized light reflected from the planet's atmosphere. In some sense,

observing the light that reflects off of the Earth during the day is in fact how we see everything around us. It also implies that astronomers, who because of their career choice are more likely to work at night, might be completely unaware of Earth's existence in the daytime and thus surprised to "discover" it from their nighttime work.

## #1372: Smartwatches

May 23, 2014

A USE FOR SMARTWATCHES:



This is even better than my previous smartphone casemod: an old Western Electric Model 2500 desk phone handset complete with a frayed, torn-off cord dangling from it.

## Explanation

Smartwatches are fairly recent innovations which function something like smartphones which are attached to one's wrist, although the screens are often shorter than those of typical smartphones, and they typically need to be attached via bluetooth to a smartphone. This comic shows someone "Case modding" some smartwatches and a broken smartphone; that is, taking the electronic innards of two smartwatches and putting them into the sawn-in-half case of a smartphone before attaching the two halves with a hinge, allowing it to open and close like flip phones, a type that was popular before the rise of smartphones.

The Western Electric Model 2500 is the last standard desk-style domestic telephone set issued by the Bell System in North America. It contains the # key and the \* key, so it can be said it has same application features as the first cellphones, but it's obviously much bigger, and of course not wireless. Smartphones usually have much more functionality. Case modding is the art of building machines (usually computers) into nicely shaped non-standard cases. The opinion about "niceness" of the result vary, as usual in art. The point is that changing the case doesn't change the functionality, so the niceness (or, usually, "coolness") is generally the only relevant feature (although, badly done modding can affect cooling).

It appears that Randall has a rather low opinion of smartwatches, as he suggests that it would be better to

take out their screens and mount them onto a dead iPhone than to use them the way smartwatches are normally used.

However, Randall's suggestion to cut open the dead phone with a hacksaw is unsound for several reasons:

1. Any attempt to saw through glass will cause it to shatter. To cut glass, one needs to grind it, not saw it.
2. Even if the phone is dead, the battery may be charged (if dead means that the battery is dead, not that the phone does not work, in which case the procedure destroys a perfectly functional iPhone). Saw blades conduct electricity, so the person might get electrocuted.
3. Some batteries contain chemicals that are toxic or explosive. Even if the battery is discharged, sawing through it is very dangerous.

To add which, the hinge depicted in the cartoon is an ordinary household hinge. It is overly large for using in electronics compared to hinges on old clamshell-style cell phones, and drilling holes in the watch cases to attach one would potentially damage the internal electronic circuits. It could also puncture the battery, causing it to catch fire. Either render the watch useless.

4. Also, it's possible the watches wouldn't fit that nicely into the iPhone.

While no phones such as the one depicted existed at the time of the comic (2014), in November 2019, Motorola officially announced a new Android phone, to be released under the Razer name, which is extremely

similar in form-factor to the fictitious phone shown in this comic, albeit with a single flexible OLED screen, rather than two separate screens.

## #1373: Screenshot

May 26, 2014

WHEN SOMEONE POSTS A  
SCREENSHOT OF THEIR PHONE,



I CAN'T PAY ATTENTION TO THE  
CONTENT IF THEIR BATTERY IS LOW.

I'M PLUGGING IN MY PHONE BUT THE BATTERY ON THE  
SCREEN ISN'T CHARGING



## Explanation

Randall is viewing a screenshot of a text-message exchange via his own phone's web browser. Such screenshots are frequently posted online, to show content ranging from humorous typos to creepy behavior. In this screenshot, in addition to the text messages' content, we see a battery bar reflecting a charge of 6%; this effectively "photobombs" (or distracts Randall from) the actual content of the original screenshot. On the other hand, the phone on which the shot is viewed is charged at a healthy 85%.

The phone the screenshot is taken from is an iPhone, while the phone being viewed is an Android. Another iPhone screenshot was the joke in 1815: Flag, where a 35% battery charge is of some minor concern to the intended recipients of the flag.

The title text suggests that Randall has plugged in his phone to quell the anxiety induced by the 6% charge in the screenshot, mistaking it for the actual battery indicator of his own phone. This measure is obviously unsuccessful, as charging his own phone does nothing to change the charge of the phone in the picture. A similar phenomenon is when a screenshot is viewed and the viewer attempts to use the controls (e.g. buttons) in the image.

Randall's fear of losing power to his phone was later explored in 1802: Phone and 1872: Backup Batteries,

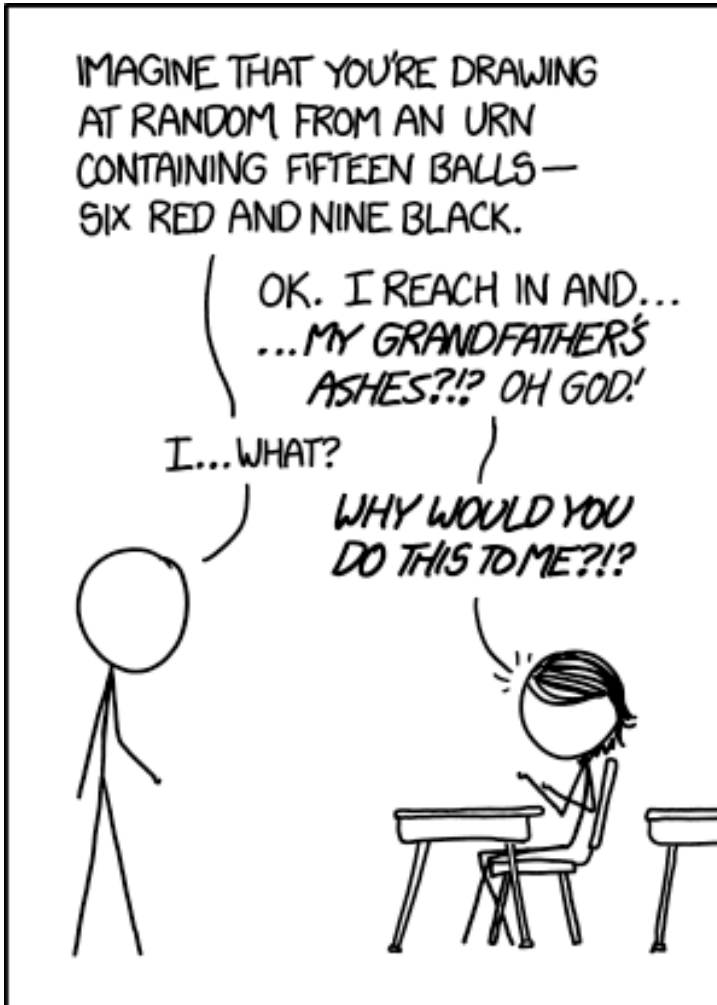
where he brings extra batteries and it is also part of the joke in comic 1965: Background Apps.

An alternative interpretation for the title text is that the screenshot was posted as part of a thread asking why their phone isn't charging. This would be ironic, as Randall's focusing on the battery level means his eyes are being drawn to the very problem being spoken about, yet he is too distracted by it to read that this is the problem!

Screenshot quality was discussed later in 1863: Screenshots.

## #1374: Urn

May 28, 2014



Can this PLEASE be drawing with replacement?

## Explanation

A common tool for explaining concepts in elementary probability theory are games involving the drawing of coloured balls from a container, such as a bag, or hat. In older statistics related texts, a convention developed of describing the container as an urn. This is so common that such problems are often called urn problems.

While an urn can have many uses, in modern times the most common context in which it is used is to contain the burned remains of deceased individuals after a cremation. This is likely because as interior decor has grown more minimalist, other types of urn became less common and the association of the word urn with cremation has become ubiquitous in the vernacular.

Megan, when asked to imagine drawing balls from an urn, imagines a cremation urn containing not only balls, but also human remains. She may be referring to a real grandfather who has been cremated, or is simply improvising a joke at Cueball's expense.

The title text refers to two distinct scenarios in the colored ball experiment: The balls may be replaced between each drawing, or not. In the former case, each draw is independent of the previous, in the latter the chances of picking a particular (remaining) ball the next time have increased. Megan (or rather Randall if it is he who speaks in the title text) would prefer to put the ashes back into the urn. She might also want to have her

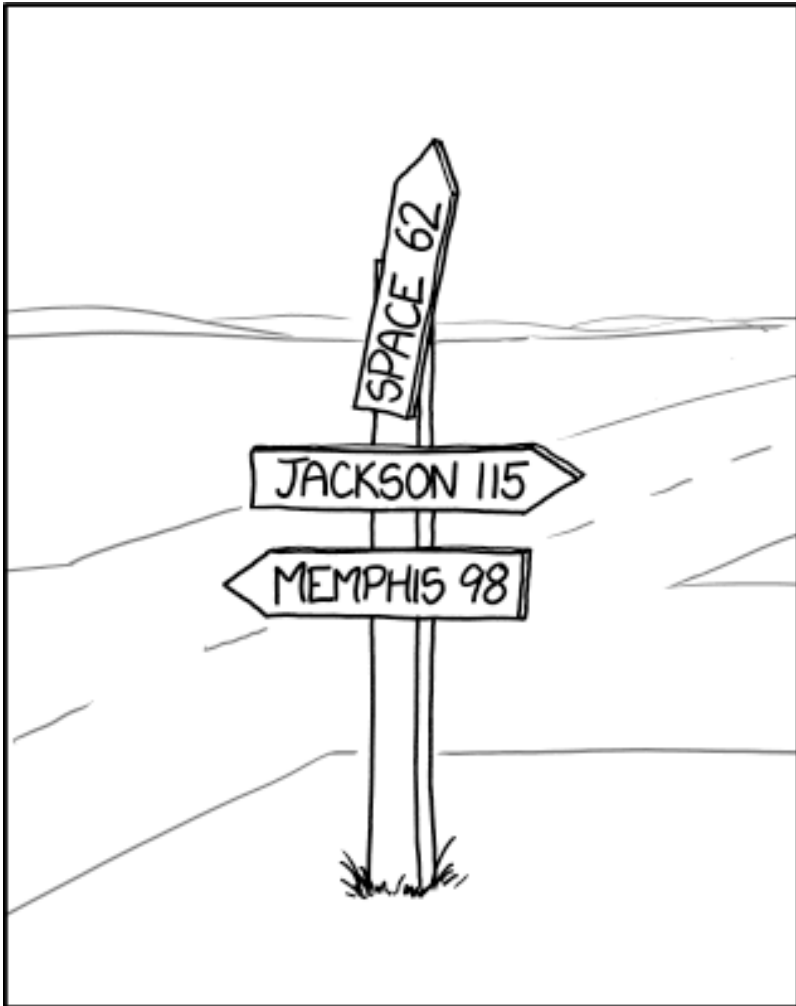
grandfather back, and be playing with the word "replacement".

The distinction between repeated drawing with and without replacement is used in most presentations of elementary probability because it illustrates a subtle but important theoretical distinction: if the balls are replaced, one at a time, before drawing the next, the number of balls of a certain color has the binomial distribution, but if the balls are not replaced, so that the same ball cannot be drawn twice, you instead get the hypergeometric distribution.

There are a myriad of reasons why Megan would want to draw with replacement, the most simple of which being that she has nowhere to put ashes other than in their designated urn. Ashes by their nature need a container, or they will make a mess; cremated remains in particular come with the additional requirement that the container be respectful to the deceased.

## #1375: Astronaut Vandalism

*May 30, 2014*



That night, retired USAF pilots covertly replaced the '62' with '50'.

## Explanation

Signs like this normally show the distance to places on earth's surface. This sign also has an arrow pointing away from earth and towards "space", with a distance of 62 miles (100 km), due to "astronaut vandalism". The 62 mile distance is the Kármán line, one of the conventional demarcations of the beginning of "outer space".

We think of space as being very far away. This comic puts into perspective that it's really a lot closer to space than to many destinations we're used to getting to by car or airplane. We think of 62 miles as being an easy trip on the ground, but that same 62 miles is incredibly hard when going vertically, against the force of gravity. And if you want to stay there for more than a moment, you need to somehow accelerate to orbital velocity—a task few vehicles available to private individuals can achieve.[citation needed]

The title text references the fact that while the Fédération Aéronautique Internationale (FAI) defines the Kármán line, the boundary between Earth's atmosphere and outer space (i.e., the start of space), to be 100 kilometers (62 miles) above mean sea level, the U.S. Air Force and other military branches will award astronaut wings to rated astronauts who fly higher than 50 miles (80 km). In 2005 NASA changed from using the FAI definition to using the USAF definition for consistency across organizations, and thus some NASA test pilots who had flown the X-15 retroactively received astronaut wings for

their greater-than-50 mi (80.5 kilometers) flights. (Air Force pilots of the X-15 in the 1960s had long since received astronaut wings for such flights.) Thus in the title text, Air Force pilots surreptitiously change the sign to conform to their definition of "space".

Although most authorities use the FAI definition of space - the Kármán line - since the FAI is the international organization of record for aeronautics, there are good scientific reasons for the U.S. Air Force definition. The line is named for Theodore von Kármán, who originally calculated the height at which a vehicle would have to travel faster than orbital velocity to generate lift from wings, therefore making the vehicle an object in orbit rather one using air to generate lift. Von Kármán originally calculated this height as 51.9 miles (83.6 km) - closer to the USAF definition than to what is now called the Kármán line. Additionally, the boundary between the mesosphere and the thermosphere is traditionally taken to be 53 miles (85 km), also close to the Air Force definition. On the other hand, some newer research suggests the mesopause (the line between the mesosphere and thermosphere) may have peaks between 53 and 62 miles (85-100 km). Also the turbopause - the line where gas molecules cease mixing atmospherically and begin stratifying by molecular weight as if they are in orbit - is generally taken to be about 100 kilometers (62 miles).

All of the atmospheric boundaries are variable, however, changing from day to day and season to season with no clear boundary. Additionally, objects cannot reliably

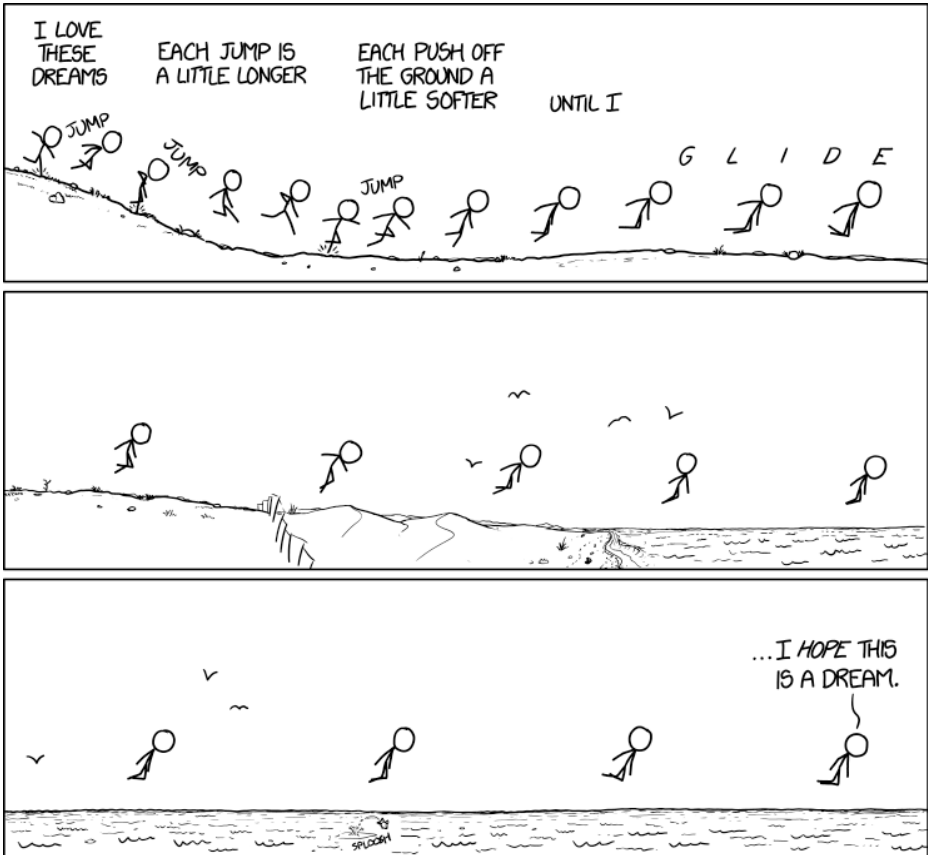


orbit below 130-150 km (80-93 miles) due to drag from even the sparse atmosphere in the lower thermosphere. Despite this comic associating "space" with having a definite start the way you might definitely know when you cross the city limits of a town, the reality is that the transition from atmosphere to space takes place gradually over tens of kilometers. Interestingly, since it is too high for aircraft and high altitude balloons, but too low for spacecraft in orbit, this "near space" transition region is one of the least-visited and least-used regions of the larger atmosphere. This comic thus both points out that the limit where space starts is arbitrarily chosen and also that space is often much closer than, for instance, two nearby cities in some randomly chosen location in the US.

The two distances shown on the signpost can occur only at certain points on Earth. One possible location is Grenada, MS, which is about 100 miles from Memphis, TN and about 114 miles from Jackson, MS. Alternatively "Jackson" could mean Jackson, TN, in which case Tupelo, MS or Kenneth, MO are both viable options for the location of the signpost. However, in Tupelo the roads to Jackson and Memphis meet at a right angle, instead of pointing in opposite directions as in the comic.

## #1376: Jump

June 02, 2014



Or that I'm at least following the curve of the Earth around to land ...

## Explanation

Cueball is presumably experiencing a common dream subject, flying or floating. As in many varieties of such a dream, the ability to fly, float or glide only gradually manifests, going from longer and longer jumps to a sort of flight or hovering. In Cueball's case, his jumps become longer and 'lighter' until at last he is gliding just above the surface of the Earth. He has apparently had such a dream before, with just such a flight mechanic manifesting itself, as he indicates that he 'loves' these dreams.

In his presumed dream, Cueball finally achieves his gliding flight just as he reaches the shoreline, and his gliding carries him over the water's edge and out to sea. After a moment's reflection, he realizes that if he were really gliding out to sea without any real apparent means of control, his situation would presumably be rather perilous — death by starvation or thirst, gradually slowing down and becoming 'stuck' over the water with no way to land, the loss of his gliding ability as suddenly as it came, etc., all suggest themselves as possible perils he would now be subject to if, in fact, his 'dream' were actual reality. Thus he eventually indicates that he hopes it is a dream, in contrast to his feeling at the comic's opening.

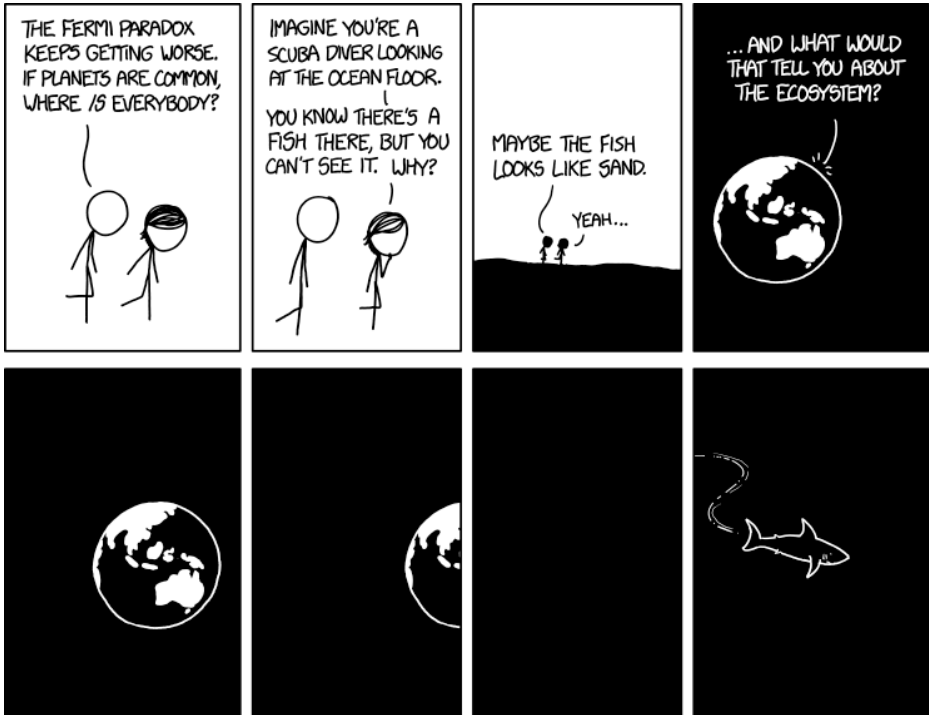
The title text adds a further worry not immediately apparent unless one considers the possibility that Cueball's 'gliding' will continue in a straight line in relation to the Earth's surface. In that case he would

continue moving straight while the Earth's surface would curve away beneath him, sending him out into space instead of the relatively preferable scenario of merely floating across the ocean to the opposite shore. After all, if the laws of physics had changed to permit hovering/flying, consequences would be unpredictable — i.e. there'd be no assurance one would maintain a constant hovering height rather than take leave of the planet as one flies forth. One thing about miracles is that all bets are off!

Also note that this situation is similar to the case of Newton's cannonball. However, that is actually in very-low-earth-orbit — and you would need to be going 7,300 m/s, or about 16,000 mph (26,000 km/h) to stay in orbit. At that speed, of course, air friction would quickly destroy the cannonball or person. This is clearly not the case in the dream. Getting weightless and drifting around was a fantasy in 226: Swingset. The comic 417: The Man Who Fell Sideways has some resemblance to this one. In 942: Juggling, Cueball throws some balls and later a book. They miss the ground. In the book Thing Explainer Cueball jumps to score with a basketball in the explanation for Playing Fields only to find that he keeps rising steadily along a straight curve up above the hoop. Very similar to this jump that just lets Cueball float straight afterwards.

## #1377: Fish

June 04, 2014



[Astronomer peers into telescope] [Jaws theme begins playing]

## Explanation

The Fermi paradox is the contradiction that arises between high estimates of the likelihood of extraterrestrial life and the fact that no evidence for it has thus far been found.

Cueball and Megan are having a conversation regarding this — since new planets are found all the time around distant stars, Cueball comments that this makes it an even greater paradox. Megan suggests that perhaps our search for extraterrestrial life is like looking at a patch of ocean floor looking for a fish. The diver knows that there must be a fish somewhere, but is unable to actually find it. She then goes on to ask why the fish would be hidden — i.e. camouflaged, and what it means about the remaining fish. The suggestion is that the fish would be hidden to avoid being eaten by predators, and perhaps the reason no extraterrestrial life is sending any sign of existence back is that they fear they might be destroyed soon after they revealed their location. Maybe they have even actively tried to hide the presence of their entire planet if they obtain the technological means. This potentially refers to the Deadly Probes scenario where a space faring species has developed deadly probes that self replicate and spread through the void between the stars - homing in on radio signals and destroying young civilizations in the cradle...

The camouflaged fish could be identified by using more sophisticated technologies like infrared cameras. Looking

at the Earth from space beyond low Earth orbit only with the naked eye wouldn't show any hint to our ecosystem. This is like the actual possibility in astronomy when observing exoplanets — the nature of those more than 1,500 known planets is unknown due to the lack of better technologies to the scientists. And there are perhaps a couple of hundred billion planets in our galaxy still camouflaged to human scientists.

The final panels take the metaphor further, suggesting that there is literally a planet sized shark swimming through space eating planets, and since the view is panning away from earth and over to the shark, the shark seems to be heading our way. Earth appears to be the next metaphorical fish, presumably because we did not reach a high enough technology level in time to recognize the danger and hide.

This also explains the title text that has the theme from the movie *Jaws* playing while astronomers look into their telescopes. This may also be a reference to the film *Alien*, which was pitched with the three word proposal "Jaws in Space."

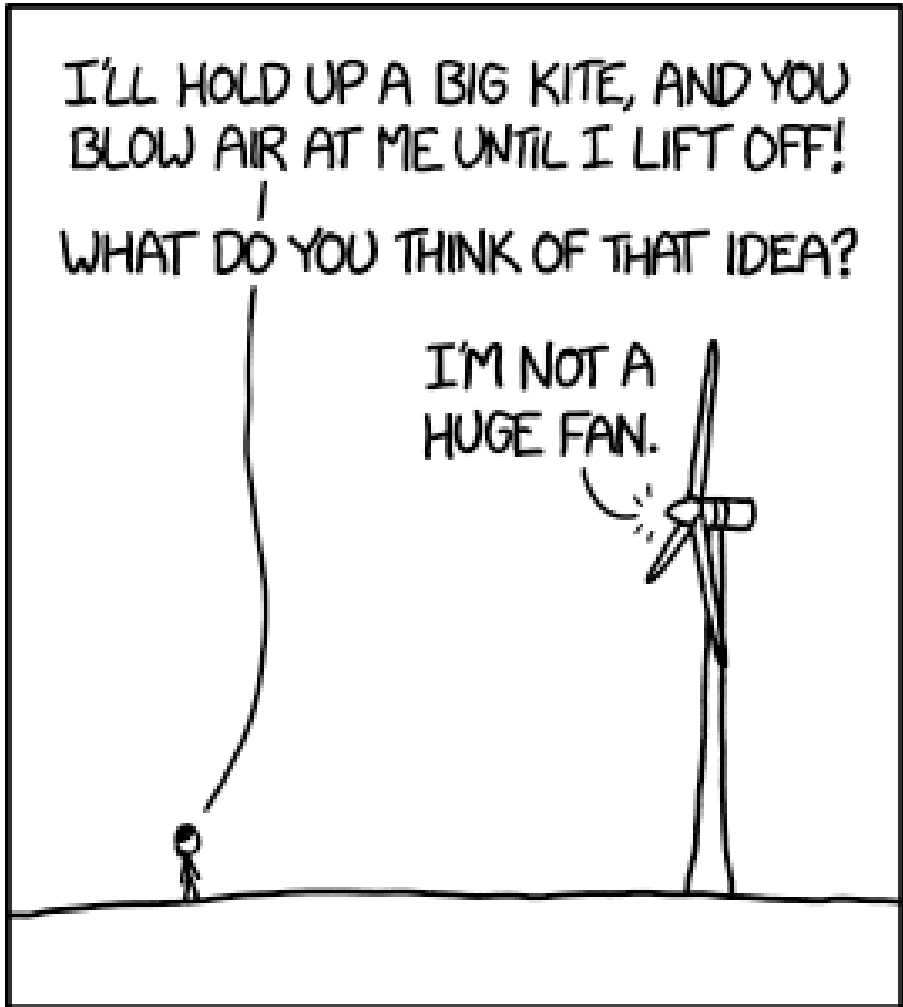
Stephen Hawking famously warns, "If aliens visit us, the outcome would be much as when Columbus landed in America, which didn't turn out well for the Native Americans." Chinese sci-fi author Liu Cixin wrote an award-winning sci-fi trilogy called the *Remembrance of Earth's Past* trilogy, which draws on a similar idea; the title of the second book, *The Dark Forest*, is a reference to the same Fermi paradox solution described in the

comic. Even Carl Sagan called the practice of broadcasting and signalling the presence of life on Earth "deeply unwise and immature," and recommended that "the newest children in a strange and uncertain cosmos should listen quietly for a long time, patiently learning about the universe and comparing notes, before shouting into an unknown jungle that we do not understand."



## #1378: Turbine

June 06, 2014



Ok, plan B: Fly a kite into the blades, with a rock in a sling dangling below it, and create the world's largest trebuchet.

## Explanation

A wind turbine uses wind to rotate its blades in order to generate electricity. It is visually very similar to an (electric) fan which however does the exact opposite: it uses electricity to rotate its blades in order to generate wind. The complementary nature of these two machines was previously highlighted in 1119: Undoing.

The punchline of this comic is a pun on the other meaning of the word "fan" which qualifies someone as liking or supporting something (here, an idea). Megan suggests to have the turbine blow air at her so she could lift off with a kite, something which would be conceivable with a huge fan, but is impossible here precisely because the turbine is not a fan and therefore can't generate wind. So the (anthropomorphically-speaking) turbine's response is twofold: 1) it's a turbine and not a huge fan, which makes the idea impossible, and 2) probably for this very reason, it doesn't like the idea - i.e. it is not a fan of the idea.

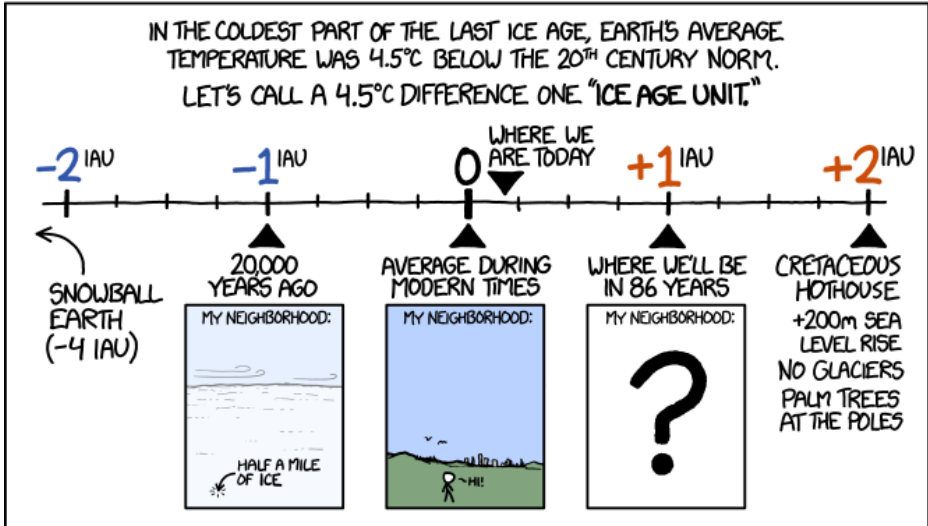
The title text alternatively suggests building a makeshift trebuchet. The idea is that when the kite's string gets tangled in the turbine's blades, the kite will be spun around and it will fling the attached rock (this setup is more similar to a traction trebuchet than to the more common counterweight trebuchet).

## #1379: 4.5 Degrees

June 09, 2014

WITHOUT PROMPT, AGGRESSIVE LIMITS ON CO<sub>2</sub> EMISSIONS, THE EARTH WILL LIKELY WARM BY AN AVERAGE OF 4°-5°C BY THE CENTURY'S END.

### HOW BIG A CHANGE IS THAT?



The good news is that according to the latest IPCC report, if we enact aggressive emissions limits now, we could hold the warming to 2°C. That's only **HALF** an ice age unit, which is probably no big deal.

## Explanation

This comic represents the impacts due to climate change by demonstrating the changes in climate that should be expected with a given change in global temperature. This is done by detailing the world's climate in geologic periods where the global average temperature has changed by one or more "Ice Age Units," or IAU. The comic defines an IAU as the difference in global temperature between today and the last ice age, about 4.5 °C. An IAU of 0 represents modern global temperature. It was later followed with a similar but much more elaborate chart in 1732: Earth Temperature Timeline.

One IAU unit happens to be the expected increase in global temperature the world will see by the end of year 2100. The prediction of 4-5 degrees Celsius of warming may not appear significant, but is easy to see as a substantial difference when comparing today to the last ice age.

An increase of 4.5 °C (+1 IAU) seems like a small change in temperature, but the changes it would cause are likely very large as it can also be described as halfway to palm trees at the poles.

The topic of ice coverage over various cities has previously been covered in 1225: Ice Sheets. The image of Boston from that comic is reused at the top of the huge chart in 1732: Earth Temperature Timeline.

This comic shows the extreme extent to which global warming can (and will) change our environment. Randall presented this view earlier in 164: Playing Devil's Advocate to Win. Climate change, especially global warming, is a recurring theme in xkcd. This is because many still believe the conspiracy theory that global warming is a hoax.

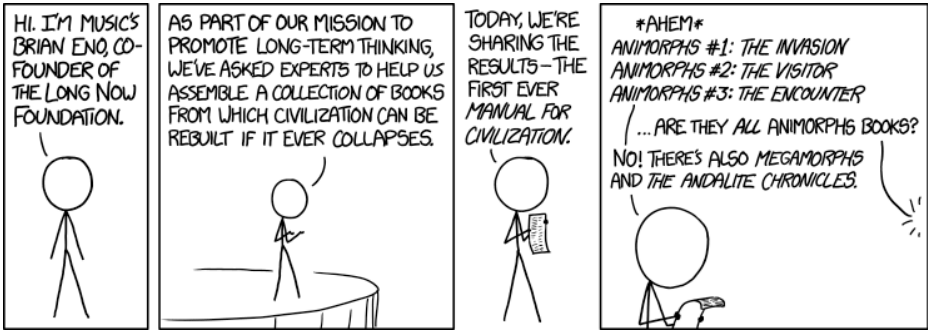
The title text expands, demonstrating that the potential impacts of an increase by the IPCC report's best case scenario of 2 °C, about half an ice age unit, makes controlling climate change seem more urgent. The figure of 2 °C is the most commonly agreed temperature target that assumes the creation of aggressive emissions limits at the time of the publishing of the comic.

### **A1F1 Scenario[edit]**

The 4.5 degree increase is predicted by the bern2.5cc simulation (a moderate simulation) of the A1F1 scenario. In the A1F1 scenario the world has a high dependence on fossil fuels, experiences "very rapid economic growth", a declining world population by 2050, as well as a high rate of increase in energy efficiency after 2050.

## #1380: Manual for Civilization

June 11, 2014



We will have an entire wing of the library devoted to copies of book #26, because ohmygod it's the one where Jake and Cassie finally KISS!!!

## Explanation

Brian Eno is a musician and a co-founder of the Long Now Foundation. He is explaining to an audience that one of the missions of the Long Now is a Manual for Civilization - a collection of reference materials that can help rebuild society in case it collapses. But in Randall's version, the experts have made a list composed of many books from the Animorphs series.

Animorphs is a series of books written by K.A. Applegate. It follows a group of five children (later, an alien joins as the sixth member), that try to stop the parasitic aliens, the Yeerks, by transforming into animals. A Yeerk that enters a human has complete control over their host, and can read their memories. Because the Yeerks can imitate their host almost perfectly, humanity is slowly being taken over without knowing it, and for this reason the children cannot contact the authorities and are on their own in the battle against the Yeerks.

When asked if all the books on the experts' list are from the Animorph series, Eno misses the point of the question by saying No!, only to mention the Megamorphs books and The Andalite Chronicles, both of which are side stories to the Animorph universe.

There are other books like these which aren't mentioned here — but it is clear from the last two panels that it is a quite long list — and it seems to be written in two columns, so maybe all 54 Animorphs books and all ten

side stories could be included on the list.

In suggesting that a series of children's novels make up the blueprint for rebuilding civilization, Randall is spoofing the idea of such libraries (since such books would be largely useless in terms of providing the detailed instructions that would be necessary). However, due to the surprisingly deep and introspective nature of Animorphs books, which several generations have grown up on, it may also entirely be possible that Randall is expressing his fondness for the series by suggesting that reading the books would be sufficient for creating the moral foundations of a functional civilization.

The title text makes it completely ludicrous by saying an entire wing of the library will be devoted to Animorphs #26: The Attack where Jake and Cassie, two main characters who have been attracted to each other since the beginning of the series, finally kiss. While this is a momentous event for fans of the book series, the information is of no consequence for the rebuilding of civilization.[citation needed]

This comic may also be inspired by Isaac Asimov's Foundation series, where Hari Seldon, a mathematician, claimed that the Galactic Empire is going to collapse in three hundred years, there is no way to stop it but his group of scientists are writing Encyclopedia Galactica to help people rebuild civilization.

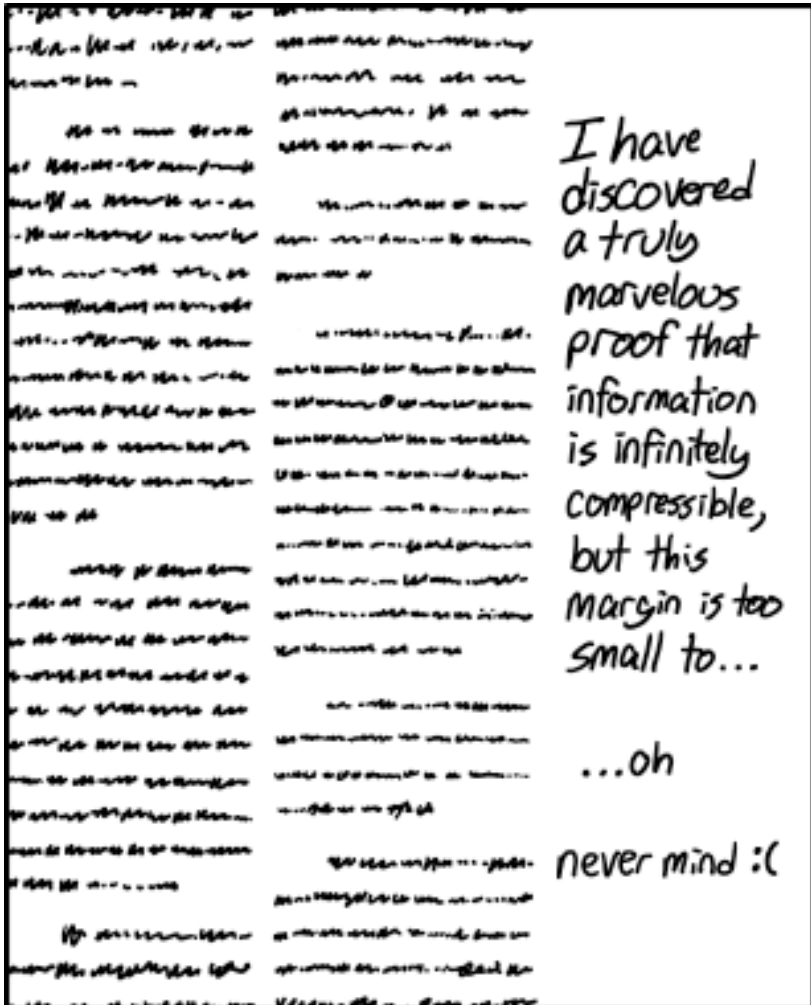
- The Long Now Foundation was mentioned three months before this comic in 1340: Unique Date.



- Animorphs was referenced before in the title text of 1187: Aspect Ratio and 1360: Old Files, and then later in 1817: Incognito Mode.

## #1381: Margin

June 13, 2014



PROTIP: You can get around the Shannon-Hartley limit by setting your font size to 0.

## Explanation

This is a reference to Fermat's Last Theorem, of which Pierre de Fermat claimed he had a proof that was too large to fit in the margin of a copy of *Arithmetica*. Despite its simple formulation, the problem remained unsolved for three centuries; it was cracked only with advanced techniques developed in the 20th century, leading many to believe that Fermat didn't actually possess a (correct) proof (see trivia).

In the comic, the person writing in the margin attempts to pull a similar trick, without actually having any proof, by claiming that he has found a proof that information is infinitely compressible, but pretending not to be able to show it due to lack of space in the margin. In this particular case, however, this approach backfires, precisely because if information was actually infinitely compressible, the writer would be able to fit the proof in the margin (due to his own proof). The writer realizes that if he had a proof he should be able to fit it into the margin, and thus he realizes that he cannot pull this trick. Or perhaps the writer really thought he had a proof, but then realized that his statement was a counterexample, and was disappointed that his idea for a proof was wrong.

What it seems he did not realize, is that it would be impossible to read the proof if the writer actually was able to compress his proof to fit in the margin. This is because you would need to know the algorithm

described in the proof before you could decompress the proof text so you can read it. So he could actually have used this trick instead, writing that he had compressed it into - say a dot "." - and then people would have to find his proof to read it. And since they cannot find such a proof - they could not check his dot. Unfortunately this would also have backfired - because there is already a proof that this is not possible!

Another thing that he probably didn't realize, is that finding a proof for something being possible does not necessarily mean inventing an actual algorithm to do that particular thing. If the person claimed having found a non-constructive proof for such an algorithm, his statement at least wouldn't contradict itself.

The title text, yet another protip, makes a reference to the Shannon–Hartley theorem, which limits the maximum rate at which information can be transmitted. Setting the font size of text only changes its representation on the screen, and not the actual characters themselves. Trying to decrease the amount of space needed to store or transmit it like advised would be nonsensical. Another possible interpretation is that if you set the font size to 0, the text cannot be seen, and therefore, nothing is being transmitted period.

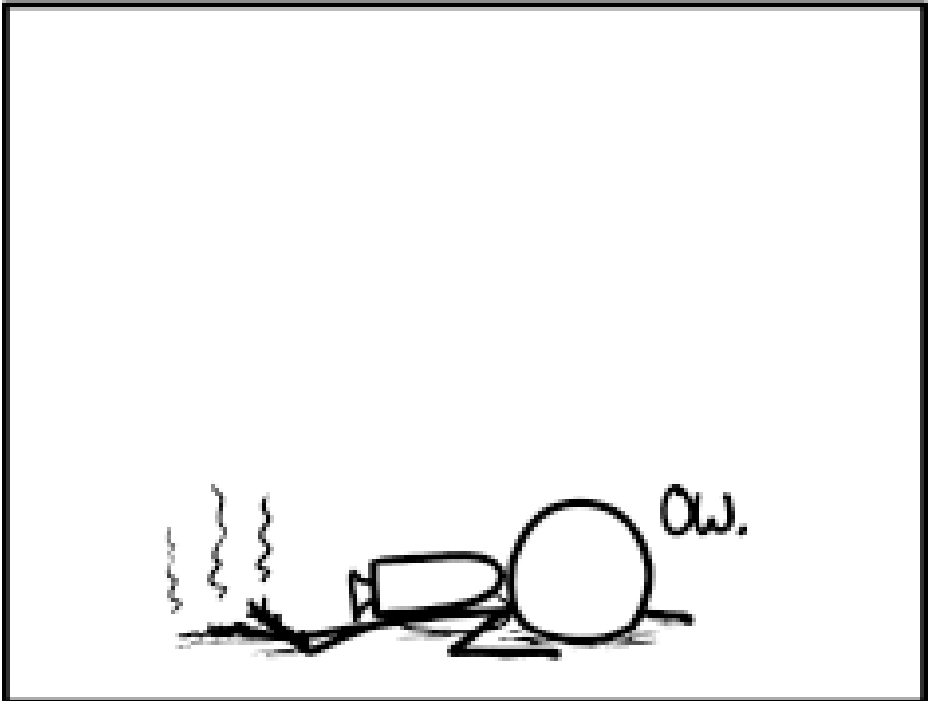
In the case of actual printed paper, decreasing the font size is valid technique for information compression (more information on the same page), as used in ie. microform. However, this comes at the cost of an increased spatial bandwidth (number of black/white

transitions per distance). In the end, the resolution of the printer/paper/microscope chain limits the minimal font size that remains useable (above the Nyquist rate).

## #1382: Rocket Packs

*June 16, 2014*

# ROCKET PACKS ARE EASY.



# THE HARD PART IS INVENTING THE CALF SHIELDS.

Every year: 'It's <year>--I want my jetpack [and also my free medical care covering all my jetpack-related injuries]!'

## Explanation

In the early 20th century, visions of the future often stipulated that everyone would travel around with rockets strapped to their backs. However, this has not yet come to pass,[citation needed] at least for the majority of consumers.

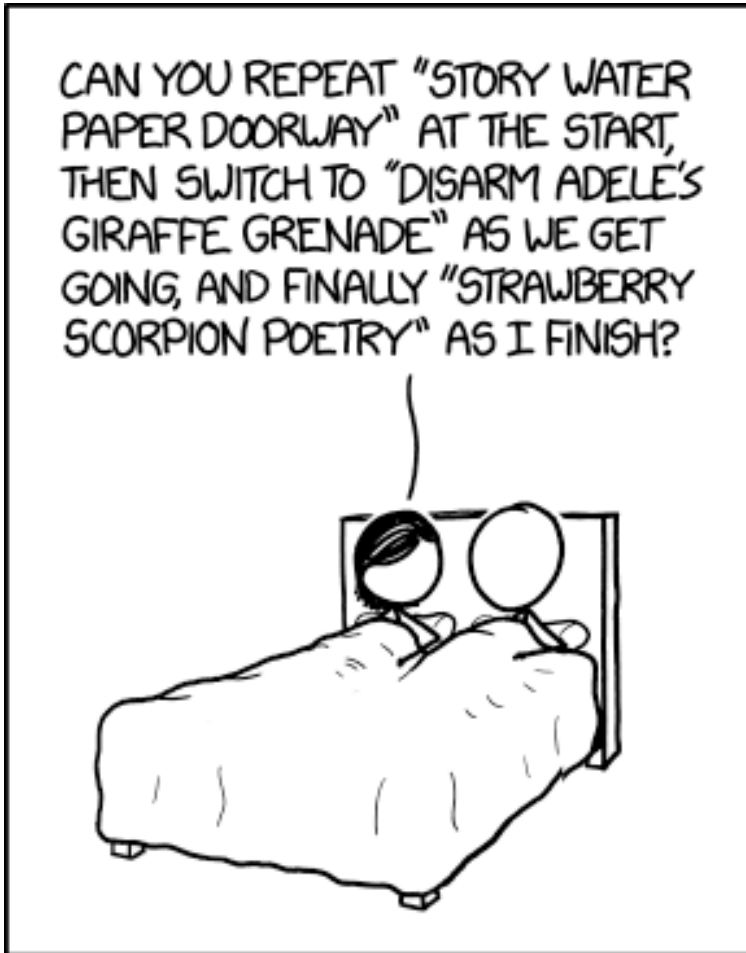
In this comic, Randall is pointing out that the problem with personal rocket packs - more commonly called jet packs - is not how to attach a rocket to someone's back, but other practical considerations. One might be how to keep the hot exhaust from burning the user's calves. Many jet pack designs actually do have ways to deal with this, such as moving the rockets farther from the user, but there are many other practical issues which have made this an impractical form of travel given current technology.

The title text starts with the trope "I want my jet pack", a theme also explored in 864: Flying Cars. It continues with pointing out that if people did start using rocket packs, there would also be more injuries, raising health care costs. That's something that people usually don't consider when imagining a future where these devices are commonplace.

So the year when the comic was published the demand was:

## #1383: Magic Words

*June 18, 2014*



LINGUIST WITH A FOOT FETISH

'And then whisper 'anapest' in my ear as you hold me?'



## Explanation

Typically the term "foot fetish" refers to a sexual attraction to people's feet. Here, though, Megan is a linguist, so for her the term "foot" refers not to the body part but to the term's meaning in prosody. In this context, "foot" means, per Wikipedia, "the basic metrical unit that generates a line of verse in most Western traditions of poetry," and thus "foot fetish" means an attraction to words that follow such a format.

Common types of feet (which are all referenced in this comic) include

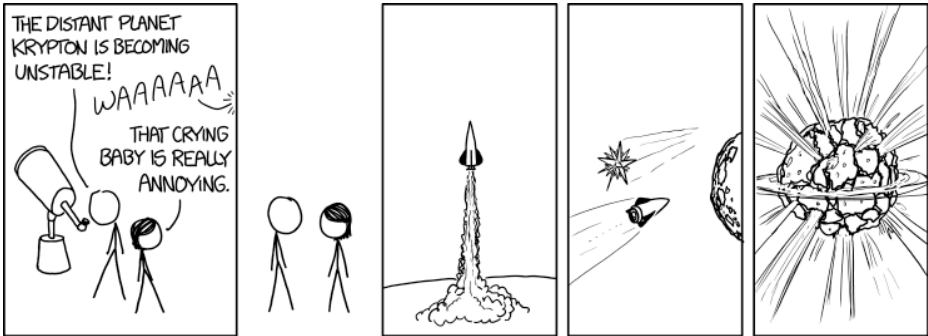
- trochee – a stressed syllable followed by an unstressed syllable (demonstrated in the first set of words: "sto-ry", "wa-ter", "pa-per", "door-way") (see also 856: Trochee Fixation).
- iamb – an unstressed syllable followed by a stressed syllable (as seen in the second set: "dis-arm", "A-dele's", "gi-raffe", "gre-nade") (perhaps the best-known foot, due to its use by William Shakespeare) (see also 79: Iambic Pentameter).
- dactyl – a stressed syllable followed by two unstressed syllables (used in the third set: "straw-ber-ry", "scor-pi-on", "po-et-ry").
- anapest – (referenced in the title text) two unstressed syllables followed by one stressed syllable; it is thus the reverse of a dactyl (see the discussion section). Note that the word anapest, pronounced "ANN-a-pest," is

itself a dactyl, not an anapest, because the stress is on the first syllable. So it is an instance of a heterological word.

Megan thus wishes that Cueball first use a trochee during foreplay, then switch to an iamb during her main stimulation phase (intercourse or some other type that still enables Cueball to speak freely), and finally switch to a dactyl as she orgasms. According to the title text, after sex she wishes for him to hold her while he whispers the word "anapest" in her ear. But for a linguist like Megan, this is just four different types of "foot" stimulation - thus she can be said to have a foot fetish.

## #1384: Krypton

*June 20, 2014*



Their Sun and gravity will make you, uh, something, I guess.  
Out of earshot from Earth, mostly.

## Explanation

This comic is an inverse version of the origin story of the superhero character Superman.

In the Superman story, Jor-El and his wife Lara notice that their home planet Krypton is about to be destroyed in a giant explosion, so they decide to send their baby Kal-El to Earth to save him – and there he becomes Superman.

In this comic, Cueball and Megan also notice that the planet Krypton is about to explode, but instead of attempting to save a baby from Krypton, they decide to send a baby to Krypton from Earth so that it'll stop annoying them with its crying.

In the fourth panel both spaceships can be seen. The rocket containing the Earth baby arrives at planet Krypton, while the crystal star shaped spaceship containing Kal-El leaves Krypton towards Earth – this is a reference to the version of the spaceship depicted in the 1978 Superman movie, (see trivia section).

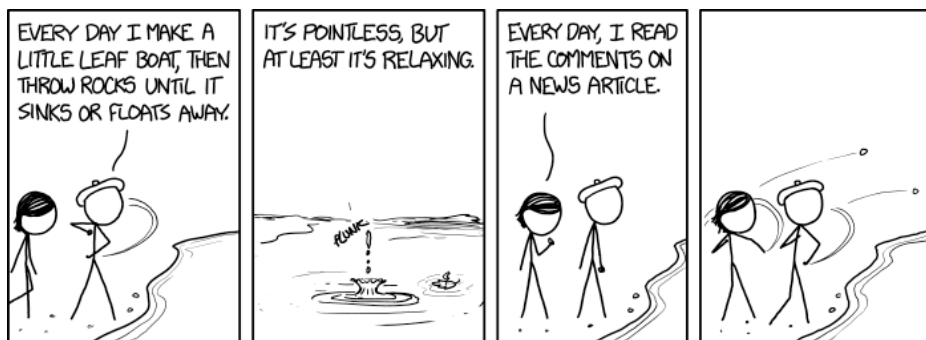
In the fifth and last panel we see Krypton explode into multiple pieces, also emitting a disc-like wave from the assumed equator.

In the Superman movie, Kal-El carries with him a lot of information pre-recorded by his parents. During the very long trip he listens to the recordings, one of which explains that the Sun and gravity of Earth will give him

(Kal-El) great powers (this is the way he becomes Superman). The title text is a satirical version of this information, given to the Earth baby during his trip: That Megan and Cueball do not have the faintest idea (or care about) what the sun and gravity of Krypton will do to it – but their best guess at what these mostly will do to it is to "make you out of earshot from Earth", which was their original reason for shipping the baby off in the first place.

## #1385: Throwing Rocks

June 23, 2014



**::PLOOOOSH::** Looks like you won't be making it to Vinland today, Leaf Erikson.

## Explanation

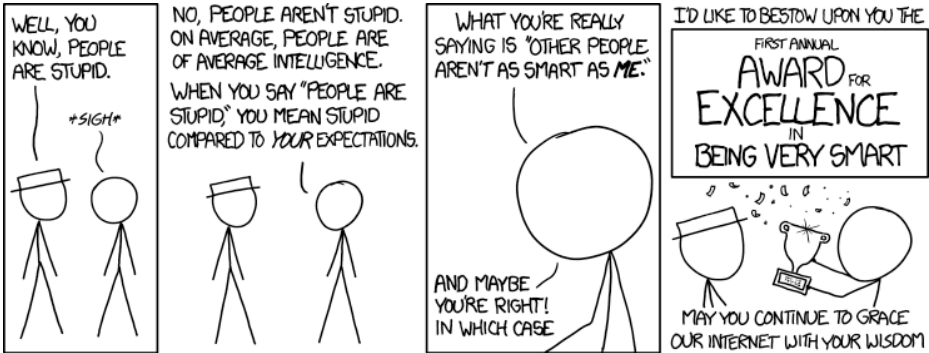
Beret Guy is showing Megan one of his daily activities: Building a leaf boat and throwing rocks at it. He acknowledges that the hobby is useless, but relaxing. In contrast, Megan contemplates one of her own daily activities: reading online comments on news articles. Realizing that it is an equally pointless, but presumably much less relaxing activity, she joins Beret Guy in throwing rocks at his leaf boat.

It is an unfortunate property of news articles that their comments become dominated by those which are deliberately offensive or devolve into flame wars. An additional metaphor may compare the article to the leaf boat while comparing the thrown stones to the flaming comments, essentially taking this most likely carefully constructed, fragile and perhaps beautiful creation (article or leaf boat) and lobbing offenses (comments or thrown stones) at it until it is dragged into the abyss (Internet "graveyard" or pond).

The title text makes it clear that they hit the leaf with a stone. The rest is a pun on the name of the 11th century Viking explorer Leif Erikson, who was believed to have been the first European to discover and settle North America, which he named "Vinland", at the time this comic was released.

## #1386: People are Stupid

June 25, 2014



To everyone who responds to everything by saying they've 'lost their faith in humanity': Thanks--I'll let humanity know. I'm sure they'll be crushed.



## Explanation

G. K. Chesterton wrote in an essay: It is stupid to say that "most people" are stupid. It is like saying "most people are tall," when it is obvious that "tall" can only mean taller than most people. It is absurd to denounce the majority of mankind as below the average of mankind.

It is a common thing for people on the Internet (on forums and comments sections of various websites) to make vague generalizations about the "stupidity of all people" or "losing faith in humanity," for instance when the topic is actually the stupidity or irrational/extreme behavior of one individual or group of individuals. The comment can come in any type of Internet forum, regardless of the subject.

However, the overall world population ("people") is not more stupid than the average - by definition. There is also no other human population to compare to to draw the conclusion this population is stupid. So it is a stupid comment that White Hat makes. The award being given to him by Cueball is thus a very sarcastic one.

It is possible that for a non-normal distribution of intelligence a median individual could be less intelligent than the mean. However, the statement as it is usually formulated (including here), "People are stupid," refers to humanity as a whole. White Hat's anecdotal and subjective experience has led him to make a statistically impossible statement.

White Hat's self-perceived superiority may be an example of the Lake Wobegon effect, so named because Lake Wobegon (a fictional city) is "where all the women are strong, all the men are good looking, and all the children are above average".

The last panel may be a reference to the First Annual Montgomery Burns Award for Outstanding Achievement in the Field of Excellence which is a fictional award in the story of The Simpsons episode Brother, Can You Spare Two Dimes? where it is presented to Homer Simpson.

In the title text the other phrase about having lost their faith in humanity also gets a comment on the way from Cueball. There are people who use this phrase every time someone disagrees with them or say something they think is stupid. He jokes that he will let humanity (everyone other than the guy who makes the comment) know that he has lost faith in them - and very sarcastically remarks that humanity will probably be crushed (i.e. the rest of the world does not care if that guy has lost faith in them).

## #1387: Clumsy Foreshadowing

June 27, 2014

### TODAY'S NEWS



NORTH KOREA THREATENS  
U.S. OVER UPCOMING MOVIE



SHARK POPULATIONS BOOMING  
OFF EAST COAST



SPACE X TO ATTEMPT NEW  
ROCKET LAUNCH TODAY



TO MAKE NEWS STORIES SEEM  
WAY MORE OMINOUS, IMAGINE  
YOU'RE HEARING THEM FROM A  
BACKGROUND TV IN A MOVIE AS  
THE MAIN CHARACTER LEAVES.

'... hosts were unexpectedly fired from ABC's 'The View' today. ABC will likely announce new ...'

## Explanation

A common trope in movies is to establish a significant event which will later become relevant to the main characters by having some kind of news reporting shown on screen. This is most commonly a television broadcast, though radio broadcasts and newspaper headlines are also used. Sometimes attention is drawn to such a news story, and in other cases, it's subtle foreshadowing that can easily be missed. In any event, if news reporting shows up in fiction, savvy viewers will immediately expect it to become relevant to the plot in short order.

Of course, in real life, news stories generally don't directly and obviously impact the lives of most people viewing them. Randall suggests that life will seem a lot more ominous if we imagine every news story as happening in the background of a movie, which would make us instinctively assume that they foreshadow something that will soon impact us directly.

In this case we see three random headings from news stories, all of which are fairly mundane in real life, but which would seem highly foreboding in a movie:

- North Korea threatens U.S. over upcoming movie comes from North Korea's official Korean Central News Agency which, shortly before this comic was released, threatened the US over the Seth Rogen movie *The Interview*, promising "stern" and "merciless" retaliation if the film was released. North Korea is

well-known for making blustering and empty threats, and few people feared a serious response, but in a movie, this would foreshadow either all-out war or an attack that would involve the protagonists somehow.

- Shark populations booming off east coast comes from a report released week before this comic, about the preservation of Great White sharks. A growing population of Great White sharks is positive news as the species is important to marine ecosystems and its numbers have declined in recent years. Sharks aren't a significant threat to humans, with fewer than a dozen humans killed by sharks in a typical year, worldwide. In a movie, however, such a report would heavily imply that a shark attack, or something similar, was imminent.
- SpaceX to attempt new rocket launch today. SpaceX is a privately owned space transport services company. On March 13, 2014 they reported a launch date for their first OG2 mission containing 6 satellites. While interesting to space enthusiasts, this is a fairly ordinary update about the progress of the company. In a movie, such a report would imply that the launch would become important to the plot in some way, which could involve the protagonists going into space, a crash or explosion affecting them, the rocket encountering some extraterrestrial threat, or SpaceX technology being used as a threat against humanity.

The title text news hosts were unexpectedly fired from ABC's 'The View' today references ABC's The View where two of the co-hosts, Sherri Shepherd and Jenny McCarthy, were simultaneously reporting leaving the

program the day before this comic appeared. In real life, this is a very mundane story which has little impact on the lives of most people. In a film, however, it becomes loaded with meaning. In a workplace drama, it could mean that the protagonist might have a chance to replace those fired leads. In a political thriller, it might be revealed that the hosts were fired to keep them from revealing sensitive information. In an action movie, those fired hosts could be involved in a deadly plot that will soon involve the protagonists. By placing real-world headlines into a fictional context, even low-stakes stories can become rich with potential meaning.

## #1388: Subduction License

June 30, 2014



'Dude, why can't you just be a normal roommate?'  
'Because I'm coming **TOWARD** you!'

## Explanation

In structural geology, subduction is the mechanism by which one tectonic plate disappears under another. This process usually creates a mountain range on the second tectonic plate, as that starts to ride over the first and the surface geology is rucked and folded upwards. Also, water entrained in the subducting plate may rise into the second plate and provokes volcanism, often resulting in a volcanic arc.

In this comic, Beret Guy is very happy because he has just received his subduction license, which may be a play on the business term production license. His roommate Cueball very reasonably asks him: Your what? But instead of answering him, Beret Guy begins to move towards him in their small room. It turns out that the license has literally enabled him to initiate subduction, seemingly at any point of his choosing and at anomalous speed, or else allowed him to perform an existing ability he had not previously felt he could legally use. As he slides slightly towards Cueball, he slowly sinks under the floorboards of the room, and in this process he creates a small mountain range on the floor. In the end, much to Cueball's consternation, these mountains turn his desk and chair over. Cueball physically falls out of the frame in the final panel, where Beret Guy is already halfway down beneath the floor. This would not be possible in real life.

The title text plays on the double meaning of the word



"normal", which Cueball means in the sense of "like most people, not strange," but which Beret Guy interprets in the geological sense. While subduction occurs when two plates crash into each other, a normal fault occurs when two plates are moving away from each other. Here, "normal" is used in the sense of "perpendicular," as the result of a normal fault is often that part of the crust moves vertically downward, forming a graben.

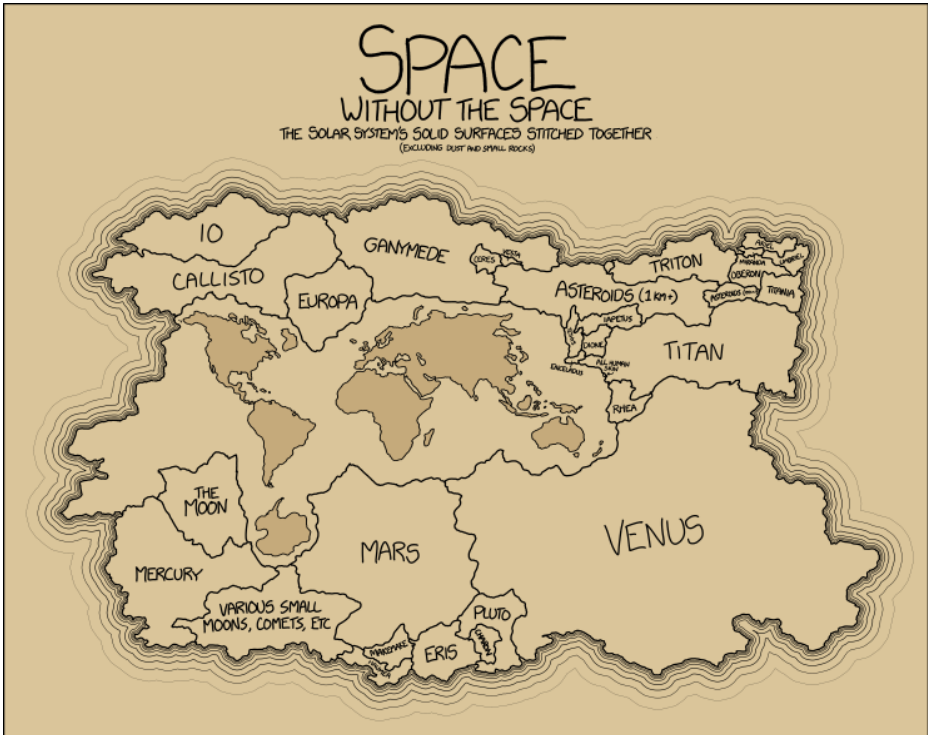
A similarly atypical license was mentioned previously in 410: Math Paper. Puns on geological terms (including types of faults) were previously made in 1082: Geology.

This comic was featured in a page of Thing Explainer as part of the explanation of the Big flat rocks we live on. Only the last three panels were used, probably because the words in the first panel were way too uncommon for the book - see more details [here](#).

Subduction was later mentioned in 1829: Geochronology and in the title text of 3021: Seismologists.

## #1389: Surface Area

July 02, 2014



This isn't an informational illustration; this is a thing I think we should do. First, we'll need a gigantic spool of thread. Next, we'll need some kind of ... hmm, time to head to Seattle.

## Explanation

This map shows the total surface areas of all terrestrial planets, dwarf planets, moons, asteroids and minor planets that are larger than 100 m in the Solar System. They have all been represented as regions of a single massive landmass - a supercontinent like Pangaea - which is clearly surrounded by some kind of ocean.

### **Solid Surfaces Present in Comic[edit]**

On the area that signifies Earth the continents are drawn using a map projection that keeps the scale of the continents correct. (This is something that Randall cares about as can be seen in 977: Map Projections). The parts of the surface of the Earth that are covered by oceans are also included in the surface area of the Earth (i.e. the map shows the Earth's crust). An extra layer of 3–4 km of water seems rather insignificant when comparing to the Earth's radius of 6,370 km. The Earth has the largest crust of all the bodies in the Solar System.

The Moon has been inlaid in this map next to Antarctica which thus makes a great comparison of how small the Moon is compared to the Earth (there is room for more than 13 lunar surfaces on the Earth). Similarly, it is clear that the planet Venus is almost as big as the Earth.

This is also the general idea of the map - to give an idea about how big the Earth is and how small many of the other known planets etc. are; both compared to Earth and to each other. The map drawn on the Earth is probably there mainly as a guide to size, because none of the features that are known on some of the other

objects, especially The Moon (i.e. craters and "seas") and on Mars (i.e. Olympus Mons), are included.

The objects mentioned by name on the map are all but one amongst those that have reached hydrostatic equilibrium and these are all included on this List of gravitationally rounded objects of the Solar System.

The one named object that is not on the above list is the asteroid Vesta, which is included because it is the second largest object in the Asteroid belt. It is placed right next to the largest object in this belt, the dwarf planet Ceres, which is no longer considered an asteroid. [actual citation needed] And next to these two are the rest of the asteroids in two areas (see below), which thus groups all asteroids together.

The only object from the above list, (that qualifies for having a solid surface in hydrostatic equilibrium), which is not included is the Saturn moon Mimas, which is also clearly the smallest object on the list.

This moon should have been located amongst the other five smaller moons of Saturn between the Earth and Titan (the largest of Saturn's moons). Mimas has a surface area of 490,000 km<sup>2</sup> which is somewhat smaller than the smallest included Saturn moon Enceladus with a surface area of 799,000 km<sup>2</sup>.

Generally the moons that belong to a given planet (for those with more than one moon large enough to be included), have been clustered together. Apart from the six (not seven...) moons of Saturn to the right of Earth, the four Galilean moons moons of Jupiter are located above the Earth, the five included moons from

Uranus is located at the top to the far right.

The last planet to have many moons is Neptune, but only Triton is included. This is a fairly large moon, and the only of the 14 known moons of Neptune to be on the above list. However, there is one other moon, Proteus which is notable for being as large as a body of its density can be without being pulled into a spherical shape by its own gravity. It has a length of 424 km in the longest direction, and a mean radius of 210 km. A rough calculation of its surface area from this mean radius gives an area of 550,000 km<sup>2</sup>, making the surface area slightly larger than Mimas. As there is an unlabeled area located right next to the other Neptune moon Triton, it is most likely that this small area should represent Proteus, and that it is an error that it was not labeled.

As this is the smallest area, the cut-off of objects could have been at 500,000 km<sup>2</sup>, as Vesta is also larger than this, which would make room for Proteus, but explain the missing Mimas.

Two of the included objects also have moons that are large enough to be included: Earth, of course, and the dwarf planet Pluto with its moon Charon. In both cases these moons have been inlaid in the area of their mother planet.

Whereas the moons of the gas giants and the asteroids have been located above and to the right of the Earth, the planets and dwarf planets have been included below earth (along with the two moons mentioned above). Mercury, Mars and Venus all touching Earth, and then below them the four Trans-Neptunian dwarf planets - the Plutoids.

On the list from above there are, however, also these 10 objects

which have not been included with name on the map. These object are, however, only likely candidates for being dwarf planets (depending on whether they have reached hydrostatic equilibrium or not), and on the map they have thus been relegated to the sections without individual names. These object are thus probably grouped together (along with other relatively small objects like comets and smaller moons) in the area labeled Various small moons, comets, etc, which is located at the bottom of the map between Mercury and Mars. The surface area for all of these object, when the surface area have been estimated, are larger than 1 million square kilometer, and thus larger than several of the named objects. So it is not the size that is the reason why such objects as Sedna and Quaoar are not included with name, but probably the fact they are not investigated enough yet.

The remaining objects in the Solar System with a solid surface are the minor planets, which on the map has been labeled as asteroids even though these objects are grouped together in several other "belts" than the Asteroid belt. Here they have been assigned to two regions at the top of the map. Above the right part of the Earth area is the area Asteroids (1 km+) which include any object not already included larger than 1 km. (As these objects are no longer round it is the largest dimension, the length, that should be at least 1 km long). And finally the area Asteroids (100 m+) thus include any object not already included larger than 100 m.

Most of the rest of the objects that have been included in these three sections can likely be found on this List of Solar System objects by size.

Tiny objects smaller than 100 m down to space dust are excluded altogether as explained in the note below the headings. This is

probably because their total surface area is impossible to estimate accurately, and also because any estimate would likely be too large to fit easily into the map.

## **Non-Solar Bodies[edit]**

Between Earth and Titan is a tiny speck noted all human skin, which is an interesting sort of solid surface. A rough estimate of the average body surface area and thus of the average area of all humans skin can be made from these average values and from population pyramids as this pyramid for 2015. Average adults have a skin area of around 1.7-1.8 m<sup>2</sup>, but as a large part of the human population are children (with skin area down to about 0.25 m<sup>2</sup> for infants) the total average will be smaller. By extrapolating the given values an average area of about 1.6 m<sup>2</sup> can be found. This would make the area  $7.2 \text{ billion} \times 1.6 \text{ m}^2 \approx 11,500 \text{ km}^2$ . This is 60 times smaller than the smallest of the labeled moons Miranda (of Uranus) with a surface area of 700,000 km<sup>2</sup>.

## **Title Text[edit]**

The title text jokingly claims that this comic is not actually for information, but rather is something Randall thinks we should really do – that is, to stitch all the solar system's solid surfaces together, as the sub-sub heading says. To do this, we would need a giant spool of thread and then something he has to go get in Seattle... which presumably must be the Space Needle, a needle-like tower in Seattle, which should then be used in this grand project.

Since the land areas are on the surfaces of spheres, this would seem impossible as it would involve lots of deformation and be

particularly challenging. It will also be very gruesome when he comes to the part of collecting (and stitching) all human skin together. The inclusion of this speck on the map is, however, also there to make it clear what the real intention is with the planets. Their surface is to be "skinned" of them, as you would have to do with the humans! Then it is all these "planet skins" that should be stitched together using the space needle. This also explains the ragged edges, and why the continents keep their correct size. It would make Randall into a planetary version of The Silence of the Lambs movies character Buffalo Bill, a serial killer who tried to make a suit out of the skin from the women he killed.

Randall would also need quite a lot of space for the very large ocean. However, the whole supercontinent is just somewhere between 3-4 times larger than the area of the Earth. And the area of the entire image is less than 9 times the area of the earth. As the formula for calculation surface areas for spheres ( $4\pi r^2$ ) goes with the radius (r) squared, the diameter of the planet needed for the experiment do not need to be larger than 3 times that of the earth. Although there are no objects in the Solar System with this particular size, it is still smaller than the gas giants, the smallest of these have a radius of almost 4 times that of the earth. Exoplanets with this range of diameters have certainly been found, however, already at 1.7 times the earth radius most planets size to be of the Super-Earth type and turns in to the gas dwarf type of planets. So an ocean of the size needed are not easy to come by.

As has been explained above the earth's surface is included disregarding surface water (oceans) and the same is valid for other objects with surface water, as the Saturn moon Titan which has great lakes (or even oceans) of liquid methane on the surface or the Jupiter moon Europa which is covered in a deep ocean with a



thick cap of ice. (Interestingly this moon is placed on the map very near to the continent of Europe - maybe for easy comparison of these two areas).

## **Gas Giants[edit]**

The gas giants Jupiter, Saturn, Uranus, and Neptune have, however, not been included because they do not have any "solid surfaces"; even if they had a solid core (which is itself not clear), this would not comprise any "surface". The gas giants are believed to lack any well-defined surface at all, with the gases that make them up simply becoming thinner and thinner with increasing distance from the planets' centers, eventually becoming indistinguishable from the interplanetary medium. But if they were included via some sort of surface definition, the map of this comic would become a tiny speck amongst the map of the gas giants. Similarly, the surface of the Sun is also not considered a solid surface but hot plasma; if it were included it would reduce even a map of the gas giants to a tiny speck.

## **Other Comics[edit]**

The map is drawn in a similar style to the two maps of the Internet that Randall has created in the past:

- 256: Online Communities
- 802: Online Communities 2

## **Data table[edit]**

Below is a table listing the object roughly in the order they would be read of the map (the same order as in the transcript.) But they can be sorted by each of the columns.

The data is taken when possible from the following table: List of gravitationally rounded objects of the Solar System, and surface area is given with three significant digits.

For Vesta and Proteus (the most likely candidate for the unlabeled area next to Triton) the area is calculated from their mean radius (i.e. they are not spherical). See also above in the explanation, also for calculating the area of all human skin.

The surface for a given object is also given as a Fraction of Earth's surface, and from this the number of times the object could be placed on the Earth's surface is given as one divided by this fraction. For instance it can be seen that The Moon's surface can be placed more than 13 times on top of that of the Earth.

## #1390: Research Ethics

July 04, 2014



I mean, it's not like we could just demand to see the code that's governing our lives. What right do we have to poke around in Facebook's private affairs like that?

## Explanation

This comic references the recent revelation that Facebook engaged in a "psychological experiment" by selectively showing users more "positive" or "negative" posts on their news feed and recording the users' comments to see if the change affected the positivity or negativity of their posts. Further experiments have since been revealed such as one that tested security measures by locking users out of their accounts.

Here, Megan is commenting on the fact that, while the media is calling this control over what content the user sees "unethical," Facebook, and other companies like Google, must, one way or another, control what content the user sees, whether to present users with a limited selection of all postings, or to tailor ads to particular users; even if the regular algorithms are not set up for psychological experiments, they are still "manipulating" what posts users see or don't see. As Megan points out, no one really knows what the "normal" constraints are of the algorithm which chooses which posts are shown on news feeds. This comic is parodying the strong reaction to what is basically already a common practice.

Accumulation, control and analysis of user-generated information can be a part of the terms of service/end-user license agreement of a Website or software. In such a scenario, the user has effectively signed his/her consent to being part of such research. Unfortunately, most users don't read the terms before

clicking the "I agree" option, so it can come as a shock when the service uses the data in a way the user hadn't anticipated. In the comic 743: Infrastructures are the same issues with Facebook and open source. And in 1150: Instagram the subject is again about how users feel used by social networks, this time by Instagram, which is now owned by Facebook.

The title text ironically/sarcastically accepts that Facebook has access to all of its users thoughts through posts and photos, and they can read them for research or other purposes, but contrasts this with a suggestion which likely mirrors how Facebook would respond to such a request that Facebook's code is private and can not be revealed to us. The title text basically appears to be musing that this is backwards, and our personal data should be considered MORE private than Facebook's programming code, which may be proprietary, but is not personal private data. It can be argued though that no one is forcing people to hand all their personal data to Facebook. If someone feels, maybe justified, that the situation is unfair, they are free not to use Facebook. It is as if someone you invited into your house was spying on you, but you felt it to be inappropriate to find out what he knew about you because that's his business. Asking for the source code might be equivalent to asking that person for the specifications of the binoculars they used for spying.

## #1391: Darkness

July 07, 2014



"GENIE, FOR MY LAST WISH, MAKE EVERYONE IN THE MEDIA FORGET ABOUT THE DAY-NIGHT CYCLE."

This was actually wish #406. Wish #2 was for him to lose the ability to remember that each new wish wasn't my first.

## Explanation

This is one of five other comics related to genies.

- 152: Hamster Ball
- 879: Lamp
- 532: Piano
- 2193: Well-Ordering Principle
- 2741: Wish Interpretation

Ponytail as a news anchor describes the sunset as though it were an unprecedented, newsworthy event, rather than something mundane that happens every day. They even have a reporter (Cueball) on the spot reporting from where the darkness has spread so far.

The sunset is a common event.[citation needed] Isaac Asimov based his short story *Nightfall* on a fictional civilization that doesn't know darkness because the planet is always illuminated by the six stars surrounding it. The story describes how people would react (mass insanity, fall of civilization) when the orbital motion of the planet eventually leads to five of the suns setting, plus one in eclipse.

Describing mundane occurrences in unusual detail, to show off how odd they really are, is something Randall has done before (for instance about dreaming in 203: Hallucinations). But the caption below the main panel adds another twist to the joke by showing that the news

report wasn't a mere imagine spot, but something actually happening due to the interference of Randall's final wish to his genie, which caused all news reporters to forget the day-night cycle.

Another possible meaning is that this comic is a reference to the way the media often talk about global warming as if each weather occurrence had meaning outside of its context like in 1321: Cold. That take on the weather and the day-night cycle being denied because of a skewed point of view was also used on the Daily Show. The segment "Unusually Large Snowstorm" from February 10, 2010, used the same trope. Several Daily Show correspondents have different views on the weather based on where they are, ending with a correspondent who equates nighttime with everlasting darkness.

The caption references the fact that there is a limit to the number of wishes. It is a common rule, often used in fiction, that you get three wishes from a genie in a bottle. There usually is an added stipulation that no wish may be used to acquire more wishes.

In the title text, however, it is stated that Randall has managed to bypass the three wish limit rule. This was accomplished by using his second wish to simply make the genie unable to remember granting the speaker any wishes. He has thus used the same trick on the genie as he used here on the media. The media wish turns out not to have been his last (i.e. third), but rather wish number 406. This shows just how far, "make someone forget something", can go by applying it to the genie.



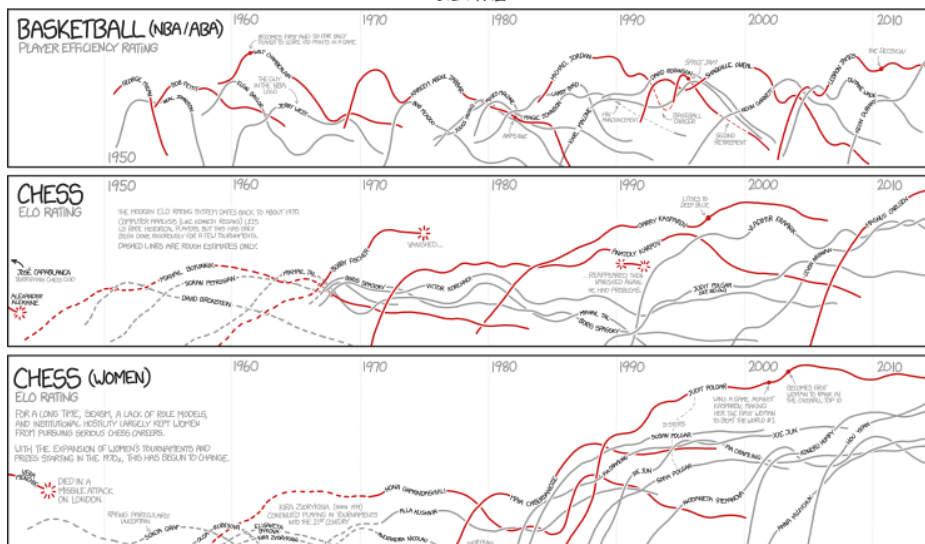
There is possibly an inconsistency in the comic, when seen from the title text's perspective. Since his second wish, all his wishes would have been seen as the first by the genie and thus, if the title text is true, he could have said: "Genie, for my first wish, make everyone in the media forget about the day-night cycle." However, in the light of the title text (to be seen as an add on, and thus not always related directly to the comics image) he appears to voluntarily end the whole scenario by explicitly declaring it over. Whether this would finally trigger the genie to end the wishing-cycle is unknown, and depends upon the exact priority of the genie's induced amnesia over its end-of-wishes habits.

It is interesting that it was his second wish that gave him unlimited wishes. What did he wish for on wish #1? Maybe he wasted the first wish because he did not believe the genie was able to grant wishes – a common error. On the other hand, he may have used the first wish to learn how to make his second wish circumvent the three rule limit. His first wish could have been to read the genie's mind to determine what he could wish for to give him unlimited wishes.

## #1392: Dominant Players

July 09, 2014

### DOMINANT PLAYERS OVER TIME



When Vera Menchik entered a 1929 tournament, a male competitor mocked her by suggesting that a special 'Vera Menchik Club' would be created for any player who lost to her. When the tournament began, he promptly became the first member of said club, and over the years it accumulated a large and illustrious roster.

## Explanation

The comic shows the rise and fall of players' strengths in two games, basketball and chess. For chess, there is an overall chart, and a women's chart. For basketball, it uses the player efficiency rating (PER), the most commonly used player statistic. Note that that player efficiency ratings and similar "aggregate scores" are the subject of much discussion in basketball due to known efficiencies. For chess, it uses the Elo rating. Elo was adopted by the World Chess Federation, FIDE, in 1970, so the rating is extrapolated backwards in time (among other methods, such as using Kenneth Regan's computer analysis - as written in the Chess panel) and are thus shown as dashed lines prior to 1970. The charts show the players career paths as a function of time with the rating on the y-axis. There is no scale on the y-axis.

Included are mainly players that could be said to have been among the dominating players at some time in their career. If a player has been the best player over a longer time period (a seriously dominating player) then their career path will be drawn in red, the rest are in gray. There can be more than one red path at a time, but only because the dominating player has played before or after they became dominating. It seems like it has to be at least five years, as there are at least two players that have been no. 1 for four years, without being upgraded to a red curve. The only ones that have managed this with three years or less (on the chart) are those that begin the chart, and thus could have been no. 1 a few years before. This

can all be seen in the data tables below.

The title text mentions Vera Menchik who is also the first female chess player listed at the left of the bottom panel. In January 1926 she won the first Girls' Open Championship at the Imperial Club in London, but as can be seen in the last panel she was killed near the end of World War II, 38-year-old, while still holding the title of women's world champion. She, her sister, and mother were killed in a V-1 flying bomb attack which destroyed their home in 1944.

The title text mentions her specifically because of the club named after her: The "Vera Menchik Club". When in 1929, Menchik entered the Carlsbad, Viennese master, usually a tournament only for male chess players, one of the other chess players, Albert Becker, ridiculed her entry by proposing that any player whom Menchik defeated in tournament play should be granted membership into the Vera Menchik Club. In the same tournament, Becker himself became the first member of the "club", much to his ridicule. It should be noted that she did end in last place vs. his fifth place, but that must just have made the defeat even tougher to take for Albert.

Albert was the first, but far from the last male chess player to enter the Vera Menchik Club. No less than 19 other male chess players are listed on Wikipedia belonging to this club, amongst them Max Euwe who went on to become World Chess Champion (1935–37). So it can for sure be said that the club accumulated a "large and illustrious roster". One and a half year later a

comic, named after Magnus Carlsen, was released (1628: Magnus). This comics also compares chess players (Magnus) to other (sporting) events. Magnus was ranked no. 1 on the chess world rank when both comics were released.

### **Chess vs chess (women)[edit]**

Why is chess divided in an overall (with only one woman included) and basketball not? First of all, there is very little focus on women's basketball (as for most women's sport). This may be the same for chess, but at least here the physical strength advantage for men is no direct advantage. Thus a great woman chess player may play just as interesting chess as a man. Whereas women would typically have no chance if playing on a basketball team with men. But why are women then not represented better on the overall chess ranking? This is explained and may be another reason it is included. In the Chess (women) panel it says: "For a long time, sexism, a lack of role models, and institutional hostility largely kept women from pursuing serious chess careers. With the expansion of women's tournaments and prizes starting in the 1970s, this has begun to change". So now at least one woman has shown that her skills is enough to compete with the best men. With the long careers chess players usually have, then maternity leave can destroy a woman's chance at reaching the ultimate top. This could be the case for the number one woman who now has two children.

### **References on the career paths[edit]**

There are several references at given times of a career path. These can either be noted with:

- A node on the path. An arrow will point to the note and state a fact.
- A dashed path, not including chess player paths from before 1970 where they were all dashed as explained above. For basketball, an arrow will point to the dashed part and state a fact.
- The starbursts at the beginning or end of a path. A fact will be stated next to the node. These are references to a player disappearing (or reappearing) in unusual circumstances in either Chess panel.

Some of these are intended to provide context (such as "Loses to Deep Blue"), while others are tangents or jokes. These references are listed below in order of appearance. If it is a dashed line or a starburst, it will be mentioned.

- Wilt Chamberlain – "Becomes the first and so far only player to score 100 points in a game". (In 1962)
- Jerry West – "The Guy in The NBA logo" from 1969: read 5th paragraph in this wiki section
- Kareem Abdul-Jabbar – "Airplane": A comedy film from 1980 where he played the co-pilot Roger Murdock.
- Magic Johnson – "HIV announcement". This part of his path is dashed. The line is dashed from 1991 to 1995 - where the fear of AIDS forced him to retire.

He returned to play once more in the season from 1995-1996

- Michael Jordan – "Baseball career". This part of his path is dashed. From 1993–1994 he played Baseball - i.e. his first retirement.

- Michael Jordan – "Space Jam". (An animated comedy film from 1996 starring Bugs Bunny and Jordan - who was the only live character during most of the movie)
- Michael Jordan – "Second retirement". This part of his path is dashed. (He retired again from 1999–2001.)

He then came back to play two more years from 2001–2003.

- LeBron James – "The Decision," a television special from 2010 about a heavily hyped decision as to which team he would play for the next season.
- José Capablanca – "Terrifying chess God". An arrow points to the left of the panel with his name and the note beneath it. He was considered one of the greatest chess players of all time. As he died in 1942 this lies just outside of the chart. Anyway he had his best years all the way back in 1921-1927 where he was world chess champion
- Alexander Alekhine – This is the first starburst. There is no text except his name. He died in 1946 in Portugal.
- Bobby Fischer – "Vanished..." The second Starburst. (He did not actually vanish, but he did stop playing competitively for about 20 years starting in 1972.) This is probably a reference to the 1993 film Searching for Bobby Fischer, which is not actually about Fischer, but about a player who partly models his career on Fischer's. The name Searching for Bobby Fischer may lead people to believe Fischer literally vanished, but that is not the case.
- Bobby Fischer – "...Reappeared then vanished again. He had problems." This is written below a double starburst with a short line between. This is another reference to Fischer - there is no

name or clear correlation, except the text that relates to the first reference. He resumed playing competitively in 1992 for a match. He had problems is a simplistic description of issues and controversies in Fischer's later life, including an arrest warrant because he violated a U.S. embargo against Yugoslavia, unpaid taxes, controversy about his statements on anti-semitism, and mental problems. The U.S. eventually revoked his passport, and he was jailed for eight months in Japan. He then received Icelandic citizenship, and lived out the rest of his life there.

- Garry Kasparov – "Loses to Deep Blue". In 1997 Deep Blue became the first computer to beat the current chess world champion
- Judit Polgar – "(see below)". The text in the brackets is written beneath her name. She is the strongest woman chess player ever and can be seen rising from the gender-defined ranks of women's chess (below). She is the only women shown on this part of the chart. Below in the womans chart, there are several notes - see below.
- Vera Menchik – "Died in a missile attack on London". This is the Last starburst. She was killed in 1944 by an early guided missile - a V-1 flying bomb - launched by the Germans in World War II. For some reason her path does not seems to be dashed, as it should have been before 1970, but it may be simply because the dashes were obscured by her name. She is also mentioned in the title text, see above in the Explanation.
- Sonja Graf – "Rating particularly uncertain". This is written above her name, with an arrow pointing there. As a matter of fact, she was clearly the second best woman and her path should be parallel to Menchik's from 1930's. The path is already dashed indicating that it is a rough estimate, but there was probably



very little data for woman chess players before 1960 explaining the note.

- Kira Zvorykina – "Kira Zvorykina (born 1919) continued playing in tournaments into the 21st century". Zvorykina was never very high on the list, but can be seen twice centered on 1960 and 1980. She played her last game rated by the World Chess Federation in October 2007 aged 88. She was still alive when this comic was released. Zvoryinka passed away in September 2014.

She is the only player in all three panels whose path falls below the panel only to enter again later. This second entry is labeled with her last name - Zvorykina - on top of the path.

- Judit Polgar, Susan Polgar and Sofia Polgar – "Sisters". These three chess playing sisters are linked by a thin dashed line, snaking between their names on the chart. Judit is the youngest, Susan the oldest. Judit has now overtaken her sisters, Sofia never reaching the other two sisters' level.
- Judit Polgar – "Wins a game against Kasparov, making her the first woman to beat the world #1". It took some attempts and some controversy before she managed to beat Kasparov in 2002, in a tournament that was played under rapid rules with 25 minutes per game and a 10-second bonus per move.
- Judit Polgar – "Becomes first woman to rank in the overall top 10". She is so far the only woman to break into the top 10 in the FIDE World Rankings. She ranked as high as eighth in the world in 2005.

## **Scales of the axis[edit]**

The x-axis is divided in decades from 1950 until 2010. In the

Basketball section the curves begins to appear right after 1950. For both chess panels there are curves further back than 1950 (with even a reference to a player from before 1940). For all three panels the paths continue up till present day (2014).

In all cases there is no scale on the y-axis with the rating, thus it is difficult to find the absolute scale. It is also difficult to compare between the two chess panels. The scale on the two chess panels are, however, the same, as can be seen by comparing the curve of Judit Polgar on each chart. This curve is exactly the same, with the same elevation between the point where her curve enters the Chess panel up to the top point. This also means that any women player whose curve rises above this entry point (around 1989) should also be visible in the Chess chart. See below for inclusion criteria.

### **Player inclusion criteria[edit]**

In general not all possible players are included in these charts. For instance it is mentioned that Judit Polgar was the first woman ranked in the over all top 10. But only six players are shown on the over all chart around 2005, where she was ranked 8th. So some male players, better than her at that time, have not been included. This is a general trend for all three charts.

From the Woman's panel below it is also clear that some of the other women would be ranked high enough to be visible on the upper chart as mentioned in the Scales section above. But still only Judit is shown there. 9 out of 12 of the women that are on the chart after 1989 would be visible if included in the overall chart. However, none of them could be called dominant when comparing to the best men in the same time period. And thus

they are not included. Maybe the same could be said about Judth, but then she is included for scale, and because she is so good that she can compete with, and sometimes beat, the best.

Some NBA players (like Tim Duncan, Charles Barkley, Oscar Robertson, Kobe Bryant, and Chris Paul) have been left out of the chart in favor of players with lower career and yearly efficiency ratings.

Similarly can be mentioned for instance the no. 1 ranked chess player Veselin Topalov from Bulgaria, who was ranked first both in 2006-2007 and in 2008-2010 for a total of less than two years. And there are likely several others (see below).

An example of the above for Basketball would be the 2008–2009 season which was unique in that it was the only season in which more than one player posted an efficiency ratings of over 30.0 on the Player efficiency rating (see at the bottom of this section on Wikipedia). In that season three players broke this barrier: LeBron James (31.76), Dwyane Wade (30.46), and Chris Paul (30.04). LeBron is shown to top that season, But Dwyane is far below (thus the scale does not fit?) and Chris is not on the list at all (i.e. he was not deemed to be a dominant player).

So is this Randall's subjective list of players that he has deemed to be "Dominant Players" and not a full list of the best ranked players during the time period? Of course it is his choice which players he put into the list, but missing players (when worse has been included earlier) can be explained if the missing players never were among the most dominant player over a length of time. It is not a list of the best players of all time, or of a single season, but a chart of the dominant players over a longer time period.

If a player only has had a very short time where their careers peaked - they should not be included. Also if there most of the time where at least two others that were more dominant than they ever where - they should not be included. To tell if this explains all the excluded players mentioned/referenced above, that would take some investigation. An investigation we can assume Randall has taken upon himself before posting this comic. This of course will still make it his subjective list.

For basketball any given player will at least have been the 2nd best (of those included) at some (longer) period of their career. And to become selected for a red curve, they need to be the best for at least five years - the first players curve is no. 1 less than five year, but he could have been no. 1 also before 1951.

The same is valid for the Chess players (again the first players curve is red, but stops just as it enters the panel). Only exception is Judit Polgar. She is never better than 3rd of those selected. And she was never better than 8th in the world. So her inclusion is a mentioned probably only to compare her with the men.

For the woman chess players there are the same criteria for red, except that Sonja Graf is not red although she is the only chess player on the list for more than a decade. Maybe you need to be better than someone else to become red? There are also included several women who never reaches 2nd place on the chart. Three of these reaches 3rd place and two only 4th. One of these, Anna Muzychuk, is still on the rise, so she might be on the chart, because she could possibly become first or second if she can continue to improve. The other, Sofia Polgar, is included to show that all three Polgar sisters are chess masters.

None of the above can explain why former World Champion Chess Grandmaster Viswanathan Anand has not been included in the Chess Chart. Anand is one of only thirteen players in history to break the 2800 mark on the FIDE rating list and still (as of 2020) has the eighth highest FIDE ranking at peak ever. He occupied the number one position in several rating lists between 2007 and 2011. The reason could possibly be because Randall may be a huge fan of Magnus Carlsen, and thus biased against Anand - there is some evidence for this in 1287: Puzzle. In the title text of that comic it seems that Randall makes fun of Anand in a match against Magnus. The interpretation of the comic and its comment, however, appear to be a double-edged matter of debate. However, since the release of 1628: Magnus, named after Magnus, there can be no doubt that Randall is a fan of Magnus.

Anand can for instance be found in the Chessmetrics devised by statistician Jeff Sonas. In the graph from 1995-2005 of Sonas famous research from 2005, Anand becomes the best during 2004. It can, however, also be seen that Randall does not agree with Sonas - this is very clear in this graph from 1940-1960. Here Mikhail Botvinnik clearly plays way better than Alexander Alekhine in 1946, where Alexander dies. This is not shown like this in the comic. Maybe the death of Alexander becomes the more interesting in the comic, if you believed he was the best at the time. Note that all nine (male) names listed in the comics chart between the lines at 1950 and 2000 are included in this graph from 1950-2000. In this chart it is clear that Bobby Fischer was by far the best in the years before he disappeared. However, he was caught by Anatoly Karpov just before which is not shown in the comic. On the other hand, he seems to have reached a significant higher rating than Kasparov ever did, which is also not

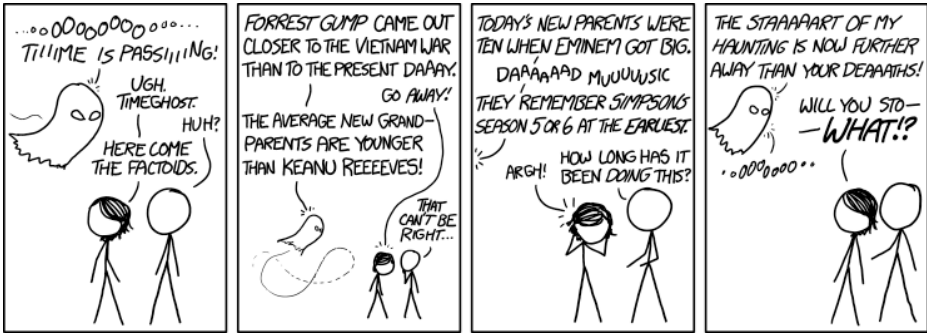
the case in the comic.

### **Entwined career paths[edit]**

Chess players Vladimir Kramnik and Levon Aronian, who have faced each other on multiple occasions in the 2010s, are shown as having their career paths entwined. It is a general trend observed every time two players paths cross each other more than once. The one on top the first time, will be below the second time and so forth. It is just more clear with these two than anywhere else. In two cases these crossing path occurs with so long time between the first appearance, that the names is written twice on the path. In the Chess panel it is Mikhail Tal and Boris Spassky and for the Chess (women) panel it is Pia Cramling and Xie Jun. This can make it difficult to get an overview of how few chess players there are compared to basketball players.

## #1393: Timeghost

July 11, 2014



'Hello, Ghostbusters?' 'ooOooOoo people born years after that movie came out are having a second chiiild right now ooOooOoo'

## Explanation

We do, however, not know how long the ghost has been haunting Megan. Also the "staaaaart of my haunting" may refer to the first time the ghost haunted anyone, not just Megan. This could be a long time ago and thus be true for anyone it meets today. Or it could mean since the start of this particular manifestation, meaning their deaths are imminent! It is also possible Timeghost is being deliberately ambiguous in an effort to frighten them even more. This is of course only scary if you believe the ghost can predict the future, which is not what it has been doing so far. There is no example in the comic where it makes a prediction that we know is accurate - only comparing time spans we can look up - see below. An alternative interpretation of the last panel is that the ghost is going to kill Cueball and Megan soon.

One thing about the prediction is true - they will eventually die. And this is the scary part about realizing how old you are and that you are quickly getting older: You will die, and "soon" (for some value thereof). The comic seems to be using "factoid" to mean a small fact. "Factoid" can also mean a "questionable or spurious statement presented as a fact", but this does not seem to be intended usage here. In this instance, some of the factoids are easily verifiable, while others are reasonable assumptions based on the number of years passed since the individual events. Several sources advocate the use of the word "factlet" to express a brief interesting fact, while using the word "factoid" for unverifiable or untrue



statements passed as fact.

While factoids tend only to have mostly only entertainment value, the last fact from the ghost is a prediction of the future (Megan and Cueball's death) which is actually of some practical value if it can be trusted. "Timeghost" might be a literal interpretation of Zeitgeist, which is a German term for "spirit of time" and refers to the school of thought that influences or dominates the art and culture of a time period. All the events and people mentioned in this comic may be considered influences on present day art and culture. Randall has covered making people feel old several times in 647: Scary, 891: Movie Ages, 973: MTV Generation (in which White Hat utters Cueball's "That can't be right" line), and 1477: Star Wars. Also see the blag post Odd Temporal Milestones. This is, however, so far the only one that makes a prediction of anyone's death. A similar ghost with a much different agenda was seen in 1108: Cautionary Ghost. Similarly annoying fact(oids) were given in 1272: Shadowfacts. 926: Time Vultures make you feel old because the entire remainder of your life is only perceived as a few moments by them.

In the title text, Megan calls Ghostbusters (from the 1984 movie) to help get rid of the Timeghost. This of course makes the ghost state that "people born years after that movie came out are having a second chiiiild right now" making her feel old once more.

Timeline

## #1394: Superm\*n

July 14, 2014



### THE NEW SUPERMOON-INSPIRED SUPERMAN REBOOT

See also: Spider-Man reboot in which he can produce several inches of web, doesn't need as much chalk powder on his hands when he goes rock climbing, and occasionally feels vaguely uneasy about situations.

## Explanation

By depicting how unimpressive the superhero Superman would be if his increase in powers, when compared to humans, were the same as the moon's increase in apparent size during a supermoon, Randall points that the use of the term supermoon is an exaggeration. This comic was released two days after such a supermoon and there was a hype in 2014 because there were three supermoons in a row as NASA said.

A supermoon is an informal astronomical event where a full moon occurs when it is closest to earth, causing the moon to appear 10% brighter and about 7% larger than the average full moon appears. This is due to the apsidal precession of moon's elliptic orbit which has an orbital eccentricity of about 0.0549. The conditions for a supermoon happen once every 411 days, and the loose definition of the term means that the supermoon lasts for about two or three full moons.

Returning to the not-so-Superman, the average American adult man is 69 inches tall, with a standard deviation of 2.9 inches. Not-so-Superman, at an assumed 74 inches (188 cm) tall, is within the 94th percentile - certainly a tall man, but by no means phenomenal. Basketball players, by way of example, are often more than 80 inches tall. "7% stronger" (most likely a reference to how the supermoon is 7% larger) is a bit harder to quantify, but it communicates "not actually impressive" to the reader all the same. For example, if an average man

can lift 50 kg, the not-so-Superman would lift 53.5 kg.

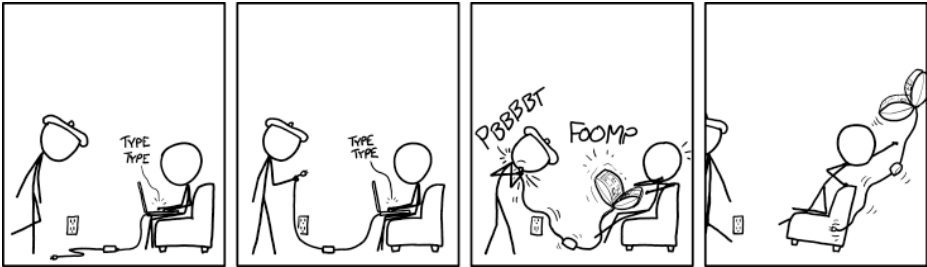
The comic's title makes use of an asterisk that is being used as a wildcard. When using search queries an asterisk represents one or more characters. Therefore, Superm\*n can represent the strings "Superman" and "Supermoon," as well as "Supermen," "Supermoan," and "Supermax prison".

The title text refers makes this same comparison with Spider-Man. Spider-Man is capable of firing large amounts of webbing, can cling to surfaces with superhuman gripping abilities, and has a sixth sense, "spider sense", that warns him about impending danger. The title text describes trivially minimal versions of these powers, analogous to the trivial size and brightness difference between a "supermoon" and a normal full moon. This also shows a much more accurate depiction of an actual spider's abilities, where they can produce several inches of a thin web, not the unrealistic amounts depicted in use by Spider-Man.

Supermoon is also referenced in panel 25 of 1052: Every Major's Terrible and shortly thereafter in 1080: Visual Field. In both cases displaying the same distaste for the formulation. Although not as clearly as here. Since then other comics have referred to the term, see this list.

## #1395: Power Cord

*July 16, 2014*



In this situation, `gzip /dev/inside` to deflate, then pipe the compressed air to `/dev/input` to clean your keyboard. Avert your eyes when you do.

## Explanation

In this comic, we see Beret Guy walking in from the left, as Cueball is sitting on a couch, typing on a laptop on his lap, with its power cord unplugged. Instead of connecting it to the wall socket, Beret Guy picks it up and blows air into the loose end of the cord, as if inflating a balloon — and the laptop inflates, along with the "power brick" that is on the cord. It then floats away, making Cueball grab for it as Beret Guy casually walks away. (See an instance where Cueball inflates something in a similar unexpected way in 1798: Box Plot).

It is not possible to inflate a laptop like this,[citation needed] and (with rare exceptions) it is not possible to inflate anything by blowing down a power cord. Beret Guy has previously demonstrated several supernatural abilities, for instance with power cords, such as in 1293: Job Interview.

In general, human breath should not be buoyant enough to lift much in an atmosphere of ordinary air (see Trivia section below for details). There is a standard cartoon convention that inflating something with breath nonetheless makes it lighter than air. Also, given Beret Guy's many manifestations of inexplicable phenomena, it is not too far fetched to believe his body is, in fact, expelling some form of lighter-than-air gas, similar to the character Rigel on Farscape who could "fart helium".

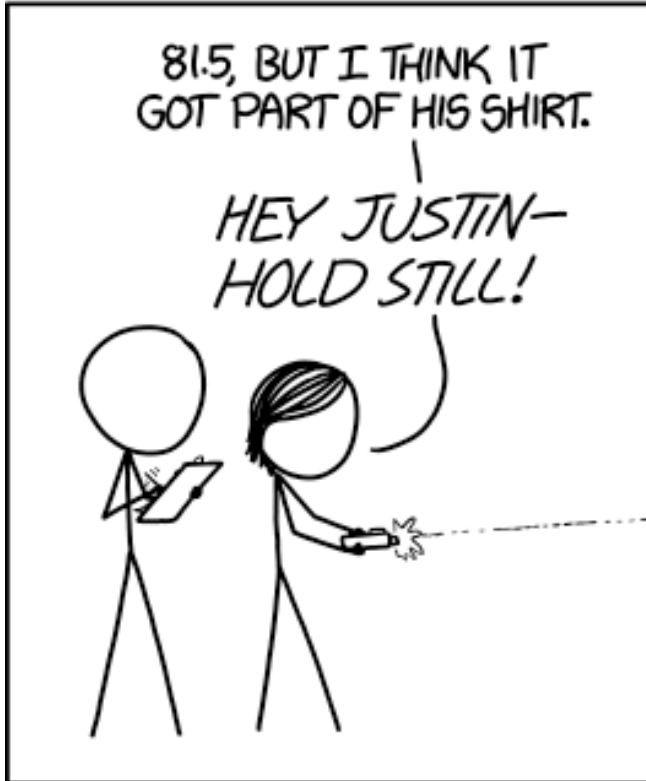
The title text involves some jokes on Unix systems. On

Unix, everything is a file; even most of the hardware can be referenced by a (virtual) file. These virtual files usually are in `/dev` or another virtual filesystem like `/sys` or `/proc`. While `/dev/input` really exists and points to the input system (mice, keyboards, gamepads, etc.), `/dev/inside` doesn't. `gzip` is a common tool to compress files. The first joke is to compress the air inside the laptop (with the command `gzip /dev/inside`) in order to deflate the laptop back to normal size. It is a pun with the literal meaning of "deflate", which is also the DEFLATE algorithm used by `gzip` (compressing files is also called "deflating"). Another joke is "piping", the act of using the output of one operation as the input to another. As the output of the `gzip` command would be compressed air, a physical pipe could be used to direct the air somewhere useful. The output of a command can also be redirected to a file. Since the hardware is a file, the suggestion is to direct the air to `/dev/input` (which, in this case, means the keyboard, but would actually be a directory on real system, which can't normally be piped into) to clean it, similar to "compressed air" dusting cans. The complete command would be `gzip /dev/inside | /dev/input`. As this might cause a spray of unpleasant detritus (compare 237: Keyboards are Disgusting), the reader is advised to avert their eyes.

## #1396: Actors

July 18, 2014

### WHO ARE TODAY'S 10 HOTTEST ACTORS?



WE GRAB AN INFRARED  
THERMOMETER AND FIND OUT!

Once again topping the list of tonight's hottest rising stars in Hollywood is Perse!



## Explanation

This comic plays on different meanings of the word "hottest". In the opening question, "Who are today's 10 hottest actors?" the word "hottest" would typically refer to an actor's popularity, success, demand, or attractiveness. Cueball and Megan interpret the word "hottest" as asking them to list the 10 actors who have the highest surface temperature, and we see them measuring "Justin's" (possibly referring to Long, Theroux, Bieber or Timberlake or any of the several other "Justin"s in show business) surface temperature using an infrared thermometer (the thermometer typically has a laser pointer to know the approximate location where the radiometric temperature comes from). The measured temperature of 81.5 is presumably reported in degrees Fahrenheit, corresponding to 27.5 °C. This temperature is below the average human internal body temperature of 98.6 °F/37 °C as skin is cooler; Megan also believes that another object (Justin's shirt) was also measured within the infrared thermometer field of view, lowering the reported measurement. With such a measurement of hotness, the hottest actor on any given day would probably be whoever is exercising, sick with a fever, or whoever has been outside in the sun the longest and/or has been sunburned, since this typically causes skin to be hot. Or, an animal actor, of a species with a higher body temperature than humans. (Category:Films about birds)

Randall here excludes the fact that accurately deriving surface temperature from bright (radiance) temperature

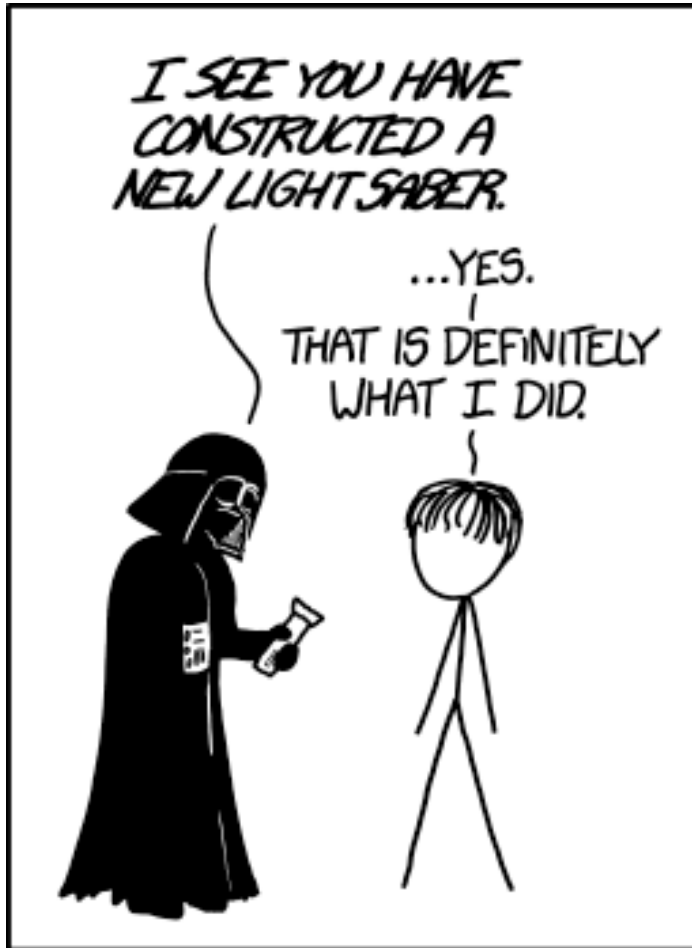
requires knowing the emissivity of the object. Since not all objects radiate with the same efficiency, two objects with the same surface temperature will emit different thermal radiance, but if emissivity is not taken into account they will report different surface temperatures.

The title-text references the temperatures of Hollywood's rising stars, this time interpreting stars as actual stars, not famous people. In this case, the star  $\xi$  Persei in the Perseus constellation (which is located in, and responsible for the fluorescence of, an object called the California Nebula), one of the hottest stars (35,000 kelvins, Sun: 5,800 K) visible to the naked eye. In July, when this comic was published, the constellation Perseus and  $\xi$  Persei with it does indeed rise a few hours after sunset from Hollywood.

Comic 1111: Premiere is another comic based on "star" puns.

#1397: Luke

July 21, 2014



VADER FINDS LUKE'S FLESHLIGHT

Don't turn it on.

## Explanation

This comic takes place in a scene from the third theatrically-released Star Wars movie, Return of the Jedi, wherein Darth Vader confronts his son, Luke Skywalker, who had recently surrendered to Imperial soldiers. In the movie Vader notes that Luke Skywalker has constructed a new lightsaber following the loss of his original during their duel on Cloud City, Luke Skywalker's original lightsaber actually having been the second lightsaber of Anakin Skywalker, who later turned into Darth Vader.

In this comic, however, Darth Vader has accidentally discovered his son's fleshlight (a male sex toy designed to imitate one of various orifices, most commonly a vagina), which he apparently brought with him on the attack on the Forest Moon of Endor. From a certain point of view, a fleshlight could be mistaken for the handle of a lightsaber, without the blade extended. Like many teenagers, Luke Skywalker is attempting to hide evidence of his sexual activity from a parent. References to fleshlights are a recurring theme in xkcd.

The title text refers to the fact that if Darth Vader turned the fleshlight on, instead of creating a blade of pure plasma or energy suspended in a force containment field the device would simply vibrate, revealing it for what it really is. Randall is also punning on "being turned on" as slang for being sexually aroused.

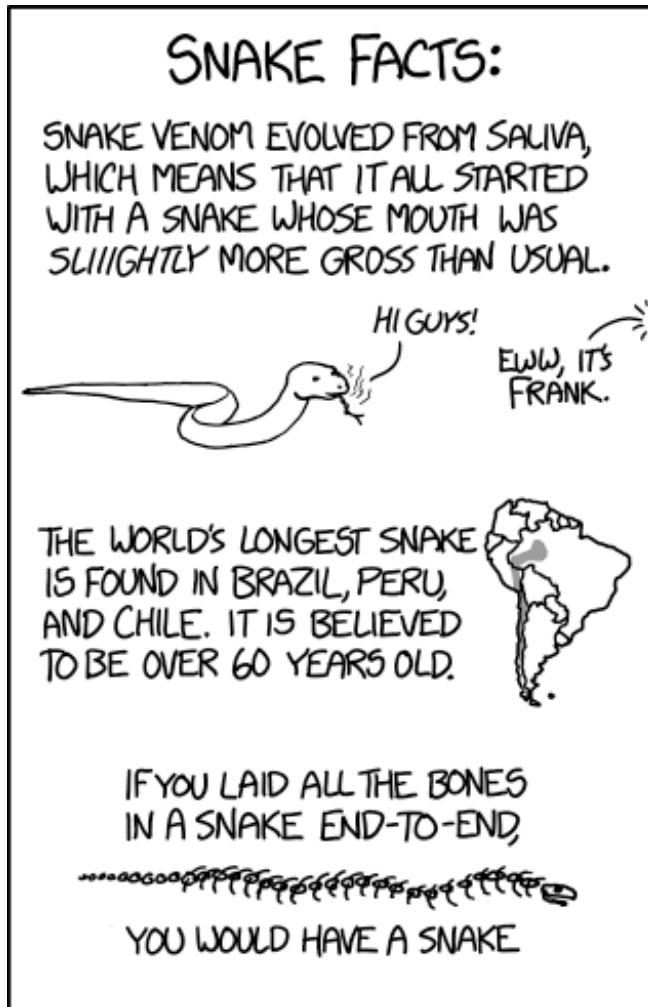
In a later comic another version of this scene is displayed

in 1433: Lightsaber. This time not so embarrassing for Luke, but much more dangerous. In that comic Luke should really have said "Don't turn it on".

In 1637: Salt Mine, Ponytail makes a very similar remark to the one that Luke makes here.

## #1398: Snake Facts

July 23, 2014



Biologically speaking, what we call a 'snake' is actually a human digestive tract which has escaped from its host.

## Explanation

This is the first comic using Facts in the title, but only the second to use a fact that is not a Fun fact. The comic lists a few factoids about snakes, ranging from the mildly informative to the strictly tongue-in-cheek. The first factoid references the hypothesis that snake venom was an evolutionary development of saliva that, over time, gradually became more toxic as snakes with saliva that was able to assist in subduing their prey possessed an evolutionary advantage. It then posits that the evolutionary branch that developed into venomous snakes began with a snake whose mutation gave him a mouth that was 'slightly more gross than usual', probably in reference to bad breath.

Additionally, the comic illustration accompanying the second factoid colors in a 'habitat range' on a map of South America that is snake-shaped, implying that when it states 'The longest snake is found in Brazil, Peru, and Chile' that this snake is so long that it literally stretches from Brazil, across part of Peru, into Chile, and that the 'habitat' shaded on the map is, in fact, this mammoth snake's silhouette. This joke plays with the fact that Chile is really thin and long. It is also much older than sixty years[citation needed]

The final factoid is entirely tongue-in-cheek. Many factoids come in the form "If you laid all the X end to end, Y would occur" (e.g. "If you laid all the veins and arteries in the human body end-to-end, they would

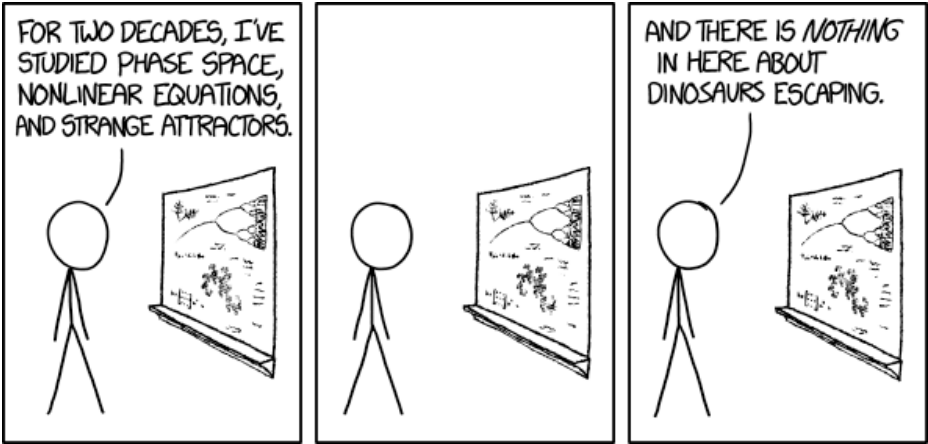
stretch 60,000 miles"). The Y portion of the factoid is supposed to be surprising; therefore, it is ironic that the factoid in the comic, "If you laid all the bones in a snake end to end, you would have a snake.", is incredibly obvious and wouldn't be considered notable by most people. Clearly, you would not have an entire snake, literally, but you would have a skeleton that was recognizably that of a snake and could reasonably be referred to as 'a snake'. A common example that pokes fun at this format is, "If you laid every elephant from end to end between the Earth and the Moon, then you'd have a lot of dead elephants."

The title text presents the amusing idea that 'snakes' as we know them are not, in fact, a suborder of reptiles but are instead human digestive tracts that, rather than being a system of organs, are creatures capable of escaping from their 'host' human and living independently. The idea seems to follow from the superficial resemblance between snakes and the human digestive tract as long, roughly tubular collections of animal matter, which can process the food entering the top end, and get rid of the waste through the other end.



## #1399: Chaos

July 25, 2014



Although the oral exam for the doctorate was just 'can you do that weird laugh?'

## Explanation

This comic pokes fun at the 1993 film Jurassic Park, which features a theme park filled with cloned dinosaurs. In the film, chaos ensues when all the dinosaurs escape and begin terrorizing their creators. The list of chaos topics, phase space, nonlinear equations, and strange attractors, comes directly from the movie, in which Dr. Ian Malcolm (portrayed by Jeff Goldblum), a mathematician and chaos theorist brought in to inspect the park prior to its grand opening, suggests that the dinosaurs' escaping could have been predicted based on mathematical chaos models.

Cueball explains that although he has also studied chaos theory, he has never seen where chaos models predict that dinosaurs would escape. Cueball's confusion highlights the contrast between the mathematical definition of chaos – shown in the graphs on the whiteboard – and its common meaning – a state of utter confusion or disorder (as illustrated in the film).

The whiteboard shows a bifurcation diagram of the logistic map (one of the simplest examples of the mathematical concept of chaos, also featured in what-if 105) and a dragon curve, which appeared on the section title pages of the novel Jurassic Park, upon which the film was based.

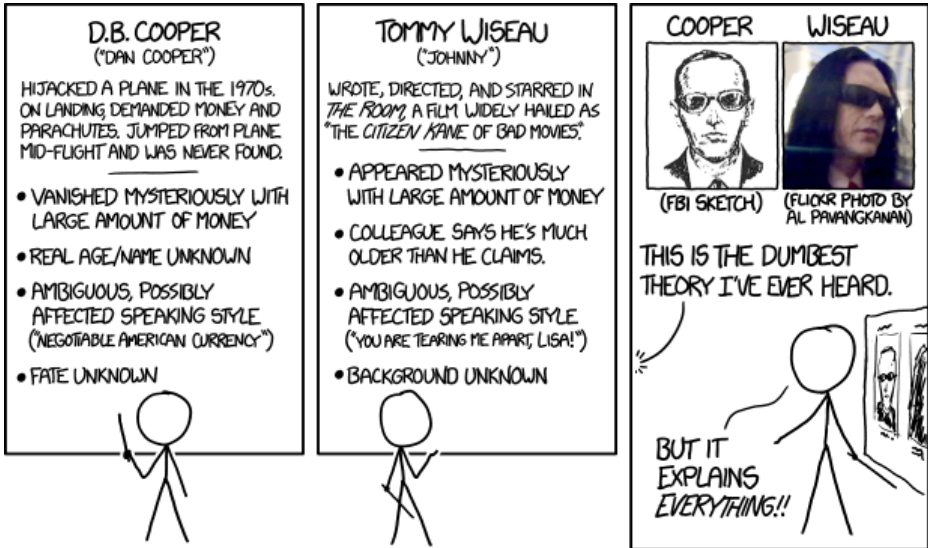
The title text references the scene in Jurassic Park in which Goldblum, as Malcolm, while making small talk

with Drs. Alan Grant (portrayed by Sam Neill) and Ellie Sattler (portrayed by Laura Dern) during the helicopter ride to the park, responds to a remark with an odd-sounding laugh. The laugh has gained minor Internet notoriety after being used as the central sample in at least one remix.

The comic may be timely, as a remastered 3-D version of the film was released in April 2013, and the fourth installment (and the first of a new planned trilogy) of the Jurassic Park film series, Jurassic World, was released in June 2015.

## #1400: D.B. Cooper

July 28, 2014



'Why on Earth would someone commit air piracy just to finance a terrible movie decades later?' 'People are very strange these days.'

## Explanation

In 1971, a man referred to by the media as D. B. Cooper hijacked a Boeing 727 and escaped with \$200,000 in ransom money (equivalent to \$900,000 in 2003 or \$1,250,000 in 2020). While the FBI maintains that Cooper was most likely killed when he parachuted from the plane, they have never determined his identity, and the investigation was called off in 2016, making it the United States' only unsolved plane hijacking. (This mystery was later referenced in 1501: Mysteries, and then again in 2452: Aviation Firsts.)

In 2003, Tommy Wiseau released *The Room*, which is considered by many to be the worst film ever made, but has also earned a sizable number of fans who uphold it as a prime example of a film that is "so bad, it's good". In the decade since, Wiseau has become something of an icon alongside his infamous movie, of which he was the producer, writer, director, and main star. Surprisingly little, however, is known about him. The comic refers to "The Room" as "...the 'Citizen Kane' of bad movies." This is a comparison between what is widely considered the best film of all time, which was, coincidentally the first film produced by, written by, directed by, and starring Orson Welles and what is widely considered the worst film of all time, the first film produced by, written by, directed by, and starring Tommy Wiseau.

This comic points to similarities between several details of Cooper and Wiseau's stories:

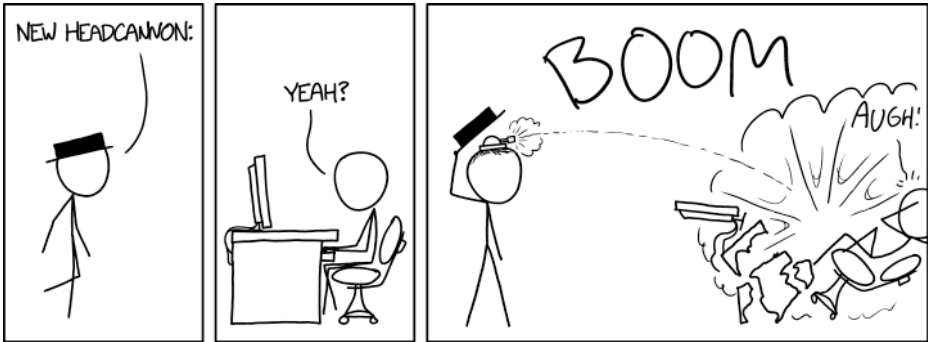
The comic then compares an FBI sketch of Cooper with a photograph of Wiseau, apparently to claim that they have similar appearances. The only real similarity is that they're both wearing sunglasses.

However, these are only a few cherry-picked aspects of their lives, and do not seriously suggest that they are the same person. For example, even if we assume that Wiseau was born in 1950, and that Cooper was only 35 (probably the youngest age which can be mistaken for mid-40s) in 1971, that leaves a 14-year gap between their ages. Likewise, Cooper was said to have either an American or Canadian accent, while Wiseau's bizarre accent is certainly not North American. While Cueball's theory in this comic is clearly a joke on Randall's part, given Randall's known distaste for conspiracy theories, this may also be making fun of people who base theories off of minor details while ignoring contradictory ones and bigger-picture questions. The question in the title text, for instance, notes that Cooper would have gone through a huge amount of effort just to produce a movie; a similar rhetorical device is often used against convoluted conspiracy theories, where one points out a vastly simpler way for the supposed conspirators to have accomplished their goals.

The title text goes on to attribute such a weird motive for hijacking to the impression that "people are very strange these days," which is another quote from *The Room*.

## #1401: New

July 30, 2014



The nice thing about headcannons is that it's really easy to get other people to believe in them.

## Explanation

This comic strip uses a play on the homophonic relationship between "canon", the literary term, and "cannon", a projectile weapon. The word headcanon is a compound of "head" and "canon," and is a term used among online discussions that means "canon that only exists within one's head." In other words it refers to belief or theory about a fictional universe that has not, strictly speaking, been proven to be true within the fiction (some headcanons can even contradict the fiction).

In this strip, Black Hat tells Cueball that he has a "new headcannon". Cueball, thinking Black Hat means "headcanon," inquires what Black Hat's new idea is. Instead of the expected idea or theory, Black Hat removes his hat to reveal a tiny cannon on his head which blows away Cueball and his computer desk.

While headcanon may often be ignored or dismissed as a personal theory, a headcannon would be far harder to ignore, as it is a physical object which has a notable (and in this case violent) impact on the real world.

In the title text Randall makes the spellings of these two words indistinguishable by using three consecutive "n"s to spell "headcannnon". Therefore, the title text is deliberately vague. It could be interpreted that it is easy to convince people that you have a cannon on your head, that it is easy to make people believe in a self invented headcanons, or both. Since you are choosing your own



interpretation of this title text, the joke is that you are creating your own headcanon.

This comic also shows Cueball being once again distracted from his work in a manner similar to 1388: Subduction License.

## **Canon[edit]**

In terms of a given literary series, "canon" describes a set of works that are collectively recognized by the community as having authenticity. Generally, works created or endorsed by the original author(s) are considered canonical. Not all original content is considered canon and not all canon is original content. Sometimes creators will rewrite the canon (called a retcon) and make things that were previously canonical non-canonical. For example, the origins of a character may be rewritten, thus invalidating the portions of the works that speak to the old origins. Other times creators will incorporate non-original content and therefore incorporate the canon of these borrowed works.

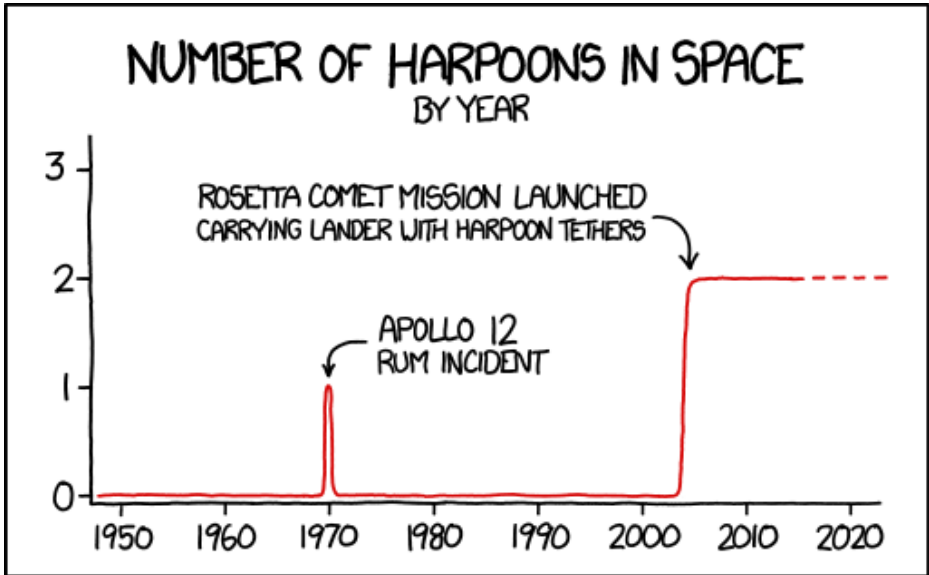
## **Headcanon[edit]**

A headcanon as the name implies is a form of canon that only exists in one's mind. More specifically, a headcanon is created when a consumer watching or reading the material develops their own ideas about a fictional universe that are not actually part of the canon, perhaps developing their own backstories or experiences for characters. Some frequent examples of headcanon include relationships between characters, abilities, events following the conclusion of the work, etc. which the author or creator has not explained or included. For example, a consumer

may "read between the lines" and assume that there was a previous romantic relationship between two characters where no conclusive evidence actually exists of one. Some fans who come up with particularly interesting or convincing headcanons may decide to share them with others in hopes that their idea spreads.

## #1402: Harpoons

August 01, 2014



To motivate it to fire its harpoons hard enough, Rosetta's Philae lander has been programmed to believe it is trying to kill the comet.

## Explanation

This comic is a graph of the number of harpoons in space over time. One would not expect that harpoons, which are associated with old technology, and sea fairing, would be used in space, which is associated with high technology. Any occurrences are unexpected, and therefore interesting or funny.

The first peak states that a harpoon was in space during the Apollo 12 mission and various possible explanations have been put forward (See discussion section below). One of more widely accepted theories proposes that Harpoon brand of Jamaican rum made it aboard the Apollo 12 rocket. Despite a fair amount of research into the basis of the harpoon incident, there have been no credible or official sources to confirm the presence of any type of harpoon on board Apollo 12. As the presence of a harpoon on board would run counter to any official story, perhaps that's exactly why it would be considered an "incident".

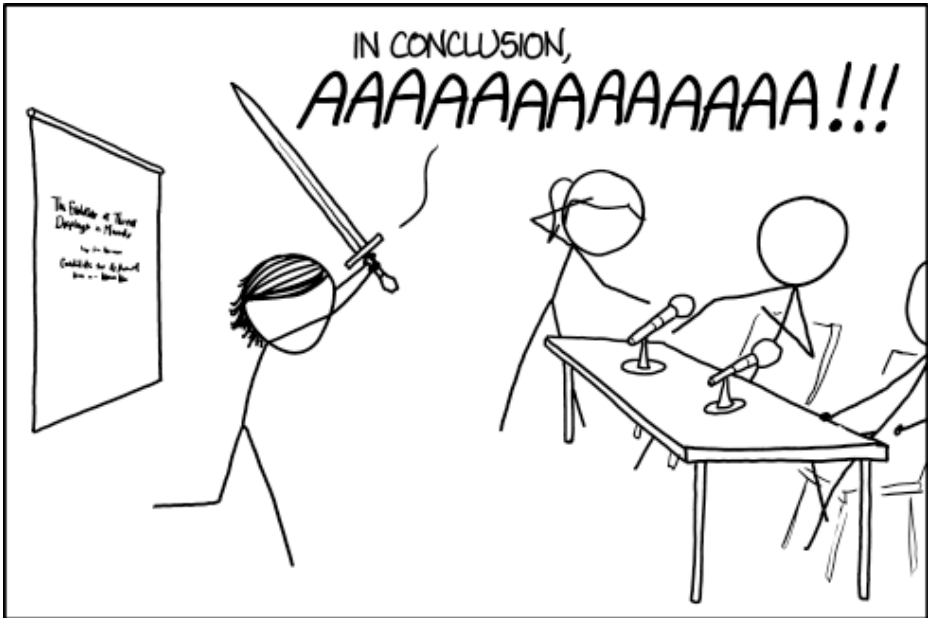
The latter peak on this graph refers to the Rosetta unmanned spacecraft. As part of its mission, it carried a lander called Philae, which has two harpoon tethers to anchor itself to the comet 67P/Churyumov-Gerasimenko. Rosetta was launched in March 2004 (as shown in the graph) and was scheduled to encounter the comet in August 2014, making this a timely comic. Rosetta maneuvered to enter orbit on September 10, and ultimately the Philae lander

touched down on the comet on 12 November 2014, although the harpoon system failed to deploy. Randall produced a live comic of the landing, updating 1446: Landing every 5 minutes with the latest progress. The Rosetta spacecraft also carries a disk micro-etched with 13,000 pages of text in 1200 languages donated by the Long Now Foundation, mentioned in previous comics.

The title text compares the Philae lander's method of deploying its tethers to whaling, in which sailors would throw harpoons at a whale with the intent of killing the whale. It was important to throw hard so the harpoon would stick in the whale so it could not get away and would tow the whaling boat until it got tired and could be killed. Thus the title text implies that the spacecraft is sentient and needs a motivation to fire the harpoons hard enough to stay anchored to the comet; to this end it has been programmed to believe that its mission is to kill the comet. Evidently this motivation was not enough, as Philae ultimately failed to deploy its harpoons - it still managed to land, though.

## #1403: Thesis Defense

*August 04, 2014*



THE BEST THESIS DEFENSE IS A GOOD THESIS OFFENSE.  
MY RESULTS ARE A SIGNIFICANT IMPROVEMENT ON THE  
STATE OF THE AAAAAAAAAAAAAART

## Explanation

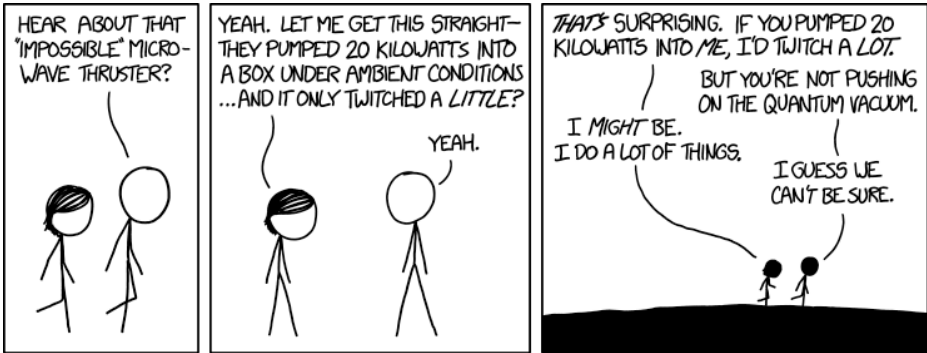
In the comic, Megan is presenting evidence on her thesis, a theory on the evolution of threat displays in mammals, in front of a panel of some people. To conclude her exposition she charges at the audience, shouting a battle cry, and brandishing a sword. The audience flinches. As the audience is composed of mammals and is responding to a displayed threat, we should assume that this response provides some key evidence about the threat displays in mammals.

This comic is a play on a thesis defense and the adage "The best defense is a good offense". The adage means that a strong offensive action will preoccupy the opposition and ultimately hinder its ability to mount an opposing counterattack, leading to a strategic advantage. A thesis defense generally involves an oral exam on the topic the candidate has chosen, and should involve no physical violence.[citation needed]

For added humorous effect, in the title text Megan extrapolates how she improved the state of the art, i.e. what she has added to her field of study, while screaming the word art.

## #1404: Quantum Vacuum Virtual Plasma

August 06, 2014



I don't understand the things you do, and you therefore may represent an interaction with the quantum vacuum virtual plasma.



## Explanation

This comic is a reference to the then-recent news of a microwave thruster which allegedly produced thrust without expelling any propellant or microwaves, a violation of conservation of momentum. This type of thruster would provide delta velocity without conventional limits. After researchers hooked their device up to a measurement apparatus in an air-filled stainless-steel chamber, applied RF input and measured changes in the apparatus, their interpretation of the results as a tiny thrust explainable under the moniker of "quantum vacuum virtual plasma" was at best controversial. In 2021, physicists at the Dresden University of Technology published a definitive analysis of their own past experiments and those of others, showing that all measured thrust could be explained by and reproduced via outside forces including heat warping of the measurement devices. Like the faster-than-light neutrino experiment, this did not pan out, and physics was not overturned.

The title of the comic directly refers to this hypothetical new physics mechanism of interacting with the "quantum vacuum virtual plasma," a combination of physics words that don't normally go together.

The first part of the comic has Megan commenting on how the engine was, in layman's terms, "twitching," and states that with that much power she'd expect something more forceful. "Twitching" is an expected outcome for

various complex systems, including biological ones, when arbitrarily large amounts of electric or microwave power is injected. The last panel is a joke about the scientific method, where equivalence between twitching and the hypothetical new physics is pooh-poohed, because Megan was not previously revealed to operate by the principle of "quantum vacuum virtual plasma," to which Megan responds that she is a complex entity and very well might have new physics inside her.

The title text suggests that the authors of the NASA paper subscribe to the principle that unexpected behaviors of complex systems should best be explained by invoking new physics rather than by making a detailed study of the complexities of the system. This runs contrary to generally accepted approach in science.

## #1405: Meteor

*August 08, 2014*



MY HOBBY: MIXING PEDANTIC TERMS

No, only LAVA is called 'magma' while underground. Any other object underground is called 'lava'.

## Explanation

This is one of Randall's My Hobby comics. The author makes semantically incorrect statements to frustrate pedantic people who know the correct word, and confuse people who don't know the precise word so they can go on using the wrong word; see also 1429: Data. Since Randall is normally personified by Cueball, it makes most sense to call the one with the hobby Cueball in the explanation below.

Cueball's friend (who also looks like Cueball) walks up to Cueball and tells him that he has found a piece of a "meteor". Cueball corrects him by telling him that what he found is called magma, and that the phrase "a piece of a meteor" would be correct if the object was in the air, once it hits the ground it is called magma. In doing so he attempts to confuse or annoy his friend. In truth, meteorite is the expression for a piece of a meteoroid that has landed; meteor is the term for the streak of light caused by the meteoroid while it falls through the atmosphere. Thus the first statement by him is a (partly) true correction, but the second one is wrong.

The word "pedantic" means being overly concerned with being precise. It is usually a pejorative term used to refer to someone who is overly fussy and corrects someone's word choice even when the more ambiguous or slightly incorrect term they used was fine for informal communication. One would tend to believe a pedant, as they would usually know what they are pedantic about.

So when Cueball is making wrong statements that seem pedantic, he may make people believe him. A volcano that would be the bane of such a pedantic person was depicted in the last panel of 1714: Volcano Types, as a direct reference to this comic.

It is also worth mentioning that, technically, water is a form of lava. Ice is a mineral, since it has a definite crystalline structure and has a definite chemical structure (H<sub>2</sub>O). And molten mineral is lava. Therefore, our bodies are made up of up to 60% lava. See Vsauce's video for more info.

The title text expands on the joke, as if the conversation had continued with a confused friend responding that he thought magma was underground. Cueball attempts to confuse him further by talking about lava which indeed is the expression for magma that has reached the surface. But it's ridiculous to suggest that all other things are called lava when underground. In the sentence he also continues to imply that magma could also be found above ground. Mixing pedantic terms like this was later used in the title text of 1967: Violin Plots. The two sentences thus follow the same pattern with one true but pedantic part to begin with, and then a false statement to confuse the victim.

## **Meteor & Magma[edit]**

Here is a list of the terminology that is being muddled:

- The descent of a small solid body from space:

A meteoroid is a small solid body traveling through space outside the atmosphere.

A meteor is a streak of light produced by a meteoroid as it burns up in the atmosphere.

A meteorite is a piece of a meteoroid remaining after it strikes the ground.

- Molten rock:

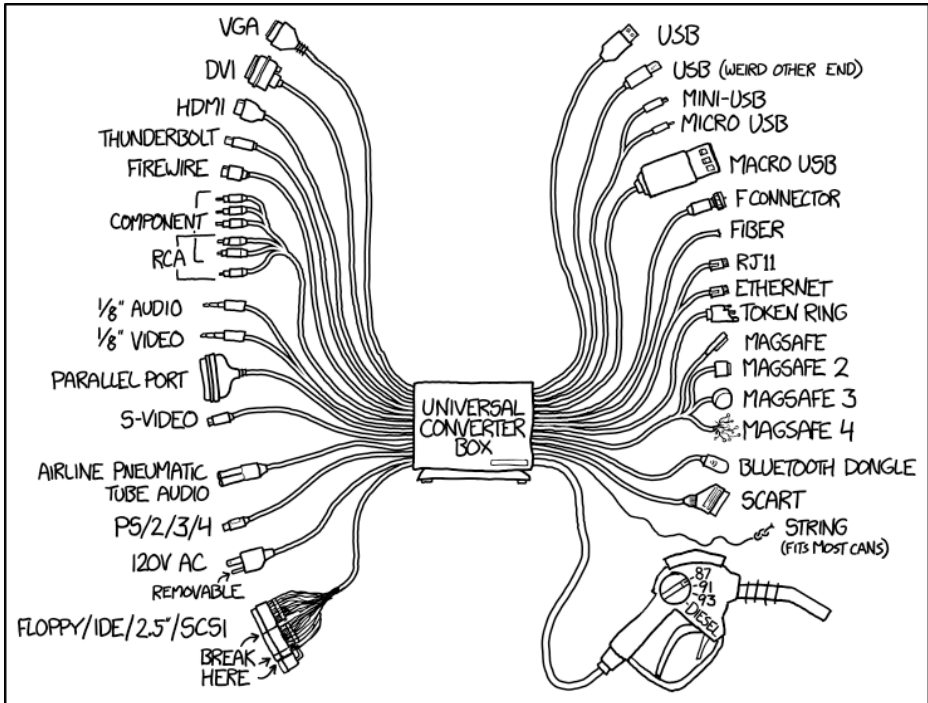
Magma flows underground.

Lava has been extruded to a planet's surface, as through volcanic eruption.

A nice English mnemonic helps: In the void, meteoroid. On the site, meteorite. Neither/Nor: meteor.

## #1406: Universal Converter Box

August 11, 2014



Comes with a 50-lb sack of gender changers, and also an add-on device with a voltage selector and a zillion circular center pin DC adapter tips so you can power any of those devices from the 90s.

## Explanation

Converter boxes are used to connect two or more devices which otherwise couldn't be, due to differently shaped plugs, different voltages, or different communication protocols.

Converter boxes or cables are commonly found for several plugs at the top of the list – such as from USB to micro-USB. As this is supposed to be a Universal Converter Box, many connections exist.

The humor from this comic comes from the sheer number of different standards that all claim to be the universal way to connect two devices, in their target market, as well as the progressively ridiculous conversions that this box is capable of doing, for example, converting audio from a 1/8 inch / 3.5 mm headphone jack into a variety of fuel suitable for running your car.

A connector is capable of making a connection to another connector only if the connectors are of the same style and the opposite gender ("male" connector is plug, "female" connector is socket), except for rare "genderless" connectors, such as the token ring mentioned above. Gender changers are devices with two connectors of the same gender. The "circular center pin DC adapter tips" in the title text are barrel jack power plugs. There are a large number of these style connectors, and many of these devices look the same, leading to frustration.



## Different connectors[edit]

The plugs are numbered from top to bottom and incremented for every wire coming directly from the converter box.

## Trivia[edit]

For some interfaces, such as USB, the female side is standard to the device while the male side is standard to the cable. For other interfaces, such as the RS-232 serial port, the conventions vary or there is no convention.

The "universal" connector here doesn't support the proper RS-232, with the closest surrogate available being RJ-11. The other nearest analog would be the parallel port, available in Centronix and D-25-pin connectors.

The SCSI connectors have been available as the "internal" connectors (see the "break-away" above) of 2 different widths, Centronix, 2 widths of the mini-D connectors with the easily bendable pins, 3 widths of the more reliable pin-less mini-connectors, and high-speed serial.

Not only is there gender and connector type but there are also different standards on what data/power is connected on each pin of the connector. Building a working connection often involved getting 3 or 4 adapters connected in a sequence to produce the right connector, gender, and pin-out.

Barrel jack power plugs were developed in the 1980s. The "barrel" has an inner diameter an outer diameter, and different style pins.

A D-shell is a trapezoidal metal skirt that protects the pins, prevents the connector from being plugged in the wrong way, and

makes the physical connection more secure.

A VGA was developed in 1987, and new versions have been developed since then.

DVI can be configured to support multiple modes such as DVI-D (digital only), DVI-A (analog only), or DVI-I (digital and analog).

HDMI has slowly been replacing DVI and VGA ports on newer devices due to the simplicity the smaller footprint and overall dimensions.

Thunderbolt is far faster than almost any connector for transferring data. However, the limited adoption by manufacturers, the higher costs of the hardware, and the security concerns inherent to the interface have limited the adoption by consumers.

Because Firewire is designed to allow backplane access and direct memory access (DMA) to devices, there are additional conversion and security issues with it.

The phone connector diameter of 1/8" is only an approximation using Imperial units. The standard actually specifies a size in the Metric system of 3.5 mm. The video plug has 3 contacts (Tip, Ring, and Sleeve) and the audio has 4 contacts (Tip, Ring, Ring and Sleeve).

While no longer common in homes or offices, parallel connections are still used in some embedded systems.

Airline pneumatic tube audio was used by in-flight entertainment systems manufactured from 1963 until 1979.

Note that while AC adapters are necessary—and widely available—to suit sockets in other countries, this "universal" converter does not feature any other AC power plugs, but this could be accommodated using adapters.

Cheater plugs exist to connect a NEMA grounding-type plug (three prongs) to a NEMA non-grounding receptacle (two slots), but the use of such an adapter can be hazardous if the grounding tab is not connected to an electrical ground. A safer alternative is to replace the outlet with a Ground Fault Circuit Interrupter (GFCI) breaker outlet.

The computer media drive connectors are unlike the motherboard-powering connectors from the Power Supply Unit of a PC, which may involve multiple additional 4, 6, and 8-pin 'breakout' supply cables that have this feature and specially 'keyed' pin-sheaths as well to allow forward/backward compatibility between various versions of PSU and motherboard that could be used (and power-hungry GPUs of various kinds, as well).

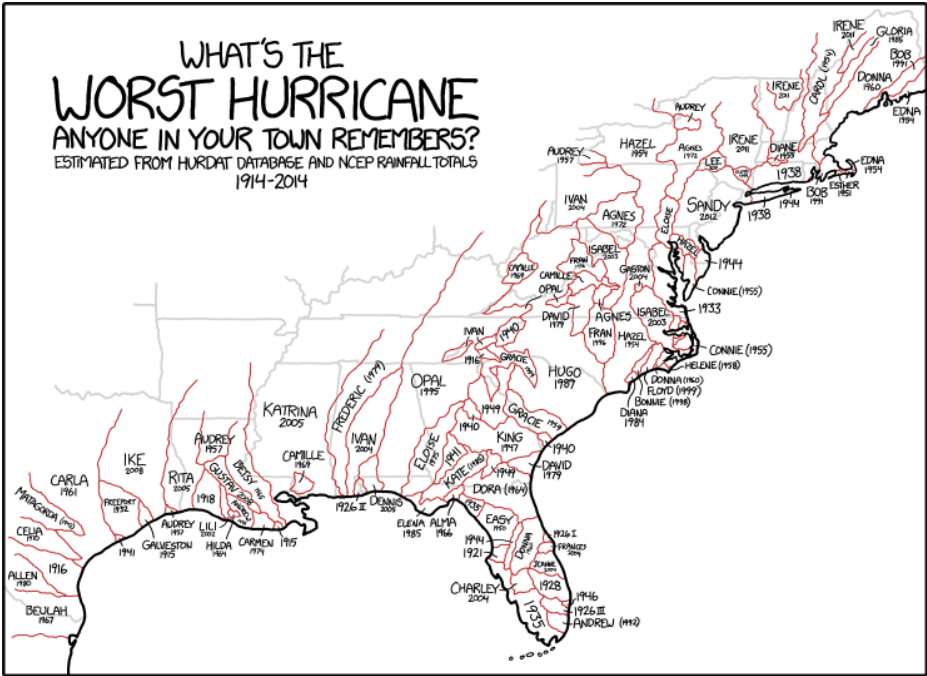
Note that some embedded systems such as cash registers actually do use larger USB connectors to include 12V and/or 24V power connections. These are not, however, called "macro-USB", and are not as large.

Other countries often use RJ11-ended cables with locally specific adapter-ends, e.g. the BS 6312 in Britain. Broadband microfilters may make use of this difference by splitting a relevant telephone plug standard into the local non-RJ11 style of telephone plug for an "audio-only" pass-through socket and an RJ11 for the router/modem to be cabled up to for the abstracted "data-only" signal — making an adapter for this will be nearly impossible.

There are two common systems for showing octane numbers on fuel pumps; the numbers shown (87, 91, 93) most closely map to Anti-Knock Index values which is used for the North American market and many other countries, the other system used in the rest of the world is Research Octane Number. In the AKI system; 87 octane (91 RON) is regular US, 91 octane (95 RON) is regular European, 93 octane (98 RON) is premium European, and in the US both 91 and 93 are considered premium/super depending on the regulations of a particular state. Some states, such as California, forbid the sale of gasoline above 91 octane. Only very rarely could both 91 and 93 be found at the same gas station. The typical line-up is "regular" (87), "plus" (89), and "premium"/"super" (depending on the state and the fuel brand, 91, 92 or 93 octane). A standard diesel nozzle (24mm) is slightly larger in diameter than a standard petrol nozzle (21mm) so you cannot tank diesel into a petrol car but if this nozzle has the petrol nozzle diameter you are still able to tank with it into some diesel cars. Some manufacturers such as Volkswagen fit a misfueling guard and fuel filler neck cap or have redesigned the fuel filler to prevent a petrol nozzle from being used in a diesel car.

## #1407: Worst Hurricane

August 13, 2014



'Finding a 105-year-old who's lived in each location and asking them which hurricane they think was the worst' is left as an exercise for the reader.

## Explanation

The map divides America's Atlantic coastline into regions according to the worst hurricane that has hit each area in the last century, based on data from the North Atlantic hurricane database (HURDAT) to determine the severity and the National Centers for Environmental Prediction's (NCEP) rainfall to determine where the hurricane was present. Most of the hurricanes are listed by their US reporting names, with hurricanes before 1953 (the year when the current naming system was established) being listed by their year and sometimes a sequence number or city name.

The title text is a joke in light of this bleak humor, saying that finding residents in each of the regions who are old enough to have been alive through all of these is quite a daunting task. In principle, this would be the only way to confirm the "worst hurricane in living memory," and may be taken as a riposte to anyone who wishes to argue this map: "If you think there was a worse one, find a 105 year old resident who agrees!" 105 was likely chosen because most people can only remember back to an age when they were 5, so someone would have needed to be 5 years old to remember a hurricane in any detail 100 years later.

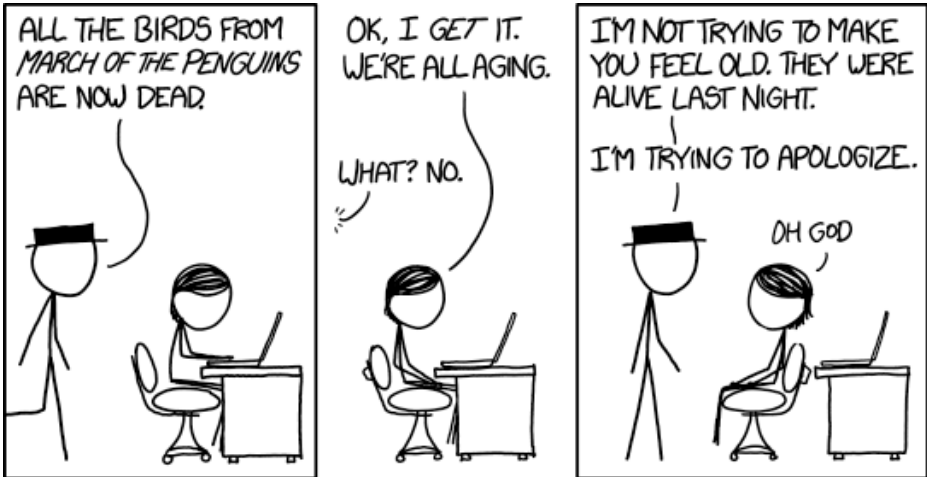
Hurricanes and especially their names have been featured before in comics 453: Upcoming Hurricanes, 944: Hurricane Names and 1126: Epsilon and Zeta.

## Listed hurricanes[edit]

A full list of North Atlantic hurricanes after Tropical cyclone naming was introduced can be found [here](#).

## #1408: March of the Penguins

August 15, 2014



You ARE getting older, though.



## Explanation

Several of the xkcd comics outline ways to make people feel older by referencing various pieces of popular culture which feel ingrained and "recent", and revealing the time that has elapsed since their release to be longer than expected (for instance, 1393: Timeghost and 891: Movie Ages).

This appears to be what Black Hat is doing as he walks in on Megan to announce that all the penguins from a 2005 documentary *March of the Penguins* about emperor penguins are dead. Megan is familiar with these sorts of antics and assumes Black Hat is indicating that the film is so old that the lifespan of emperor penguins is less than the time since the documentary was released. Frustrated, Megan simply acknowledges Black Hat's statement by agreeing that everyone is aging. Black Hat, however, reveals that he is not trying to make her feel old, because the penguins were all alive "last night" and all died in one instance since then and thus not from old age.

His announcement that he is "trying to apologize" creates the obvious inference that he caused the penguins to be killed (either intentionally or by mistake). This gives the situation a much darker tone; especially since Black Hat likely is not truly apologizing, as he is very unapologetic in his "classhole" tendencies, and just wish to mess even further with Megan.

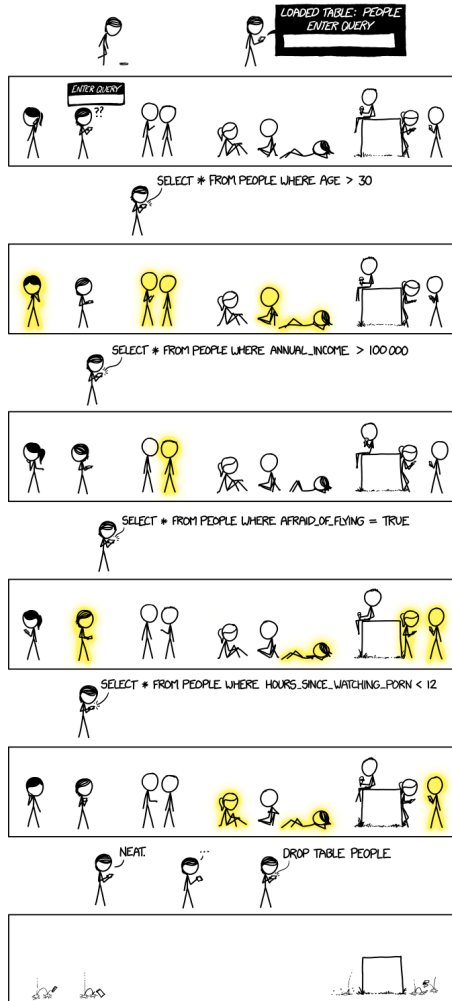
Emperor penguins actually live about 20 years on

average, so presumably, barring any intervention by Black Hat, most of the younger penguins and many of the older penguins in the movie were still alive at the time of release of this comic in 2014, nine years after the documentary was released.

The title text emphasizes that whatever the penguins' fate, we do get and are getting older.[citation needed] This is presented as a last jab by Black Hat as he departs just to make Megan feel a bit worse. So in the end this comic did try to make the reader feel older.

# #1409: Query

August 18, 2014



SELECT \* FROM GHOSTS

## Explanation

Megan picks up a strange device that mysteriously asks her to enter a query after stating "Loaded table: People/ Enter query." In computer databases, "tables" are groups of similar information consisting of records each having certain attributes. Databases are generally made up of many tables, each containing different types of records. A database for a traditional library might have a "Books" table and a "Cardholders" table with records of all of the books in the library, and all of the people who have library cards. Each table will have different columns for certain attributes for every record. For example, the "Books" table might have columns for "title", "author", "date", etc.

A request from a database by a user is called a "query". SQL (Structured Query Language) is a programming language designed for databases, and has a certain syntax for its queries. A common query is "select" which requests certain information from the database. In the library example, one might select (in plain English) all books written by a certain author or published after a certain date, etc.

Megan uses the device by entering an SQL query into it: "Select \* from people where age > 30" (show all the people older than 30). It appears that the actual people around her who are over 30 are wrapped in a yellow light, which does not apply to Megan in this query. Megan then tries other experimental queries, presumably to

determine whether the results are correct. First, she queries for people with a high annual income (a group that does not include her), then for those who are afraid of flying (which does include her). Because the results for herself are valid both times, she then indulges her curiosity by asking who has watched porn in the preceding twelve hours. This suggests that whatever "database" she is accessing is extremely thorough as it contains updated records of people's day-to-day activities.

The percentage of people lit appears to approximately correspond to real demographic data: note, 5 of the 10 characters are female; the median world/US age are fairly close to 30; top decile income in the USA is approximately \$100,000 (and top earners are usually men); up to 40% of people are afraid of flying.

Finally, she types "Drop table People". Drop is an SQL command to delete a table. When she enters the command the entire table disappears and because she is also in this table she disappears, too. The implications are unclear. It may be a suggestion that all of reality is a computer program, all of the people are merely "data" in the program, and Megan was somehow granted access to the database for the program. It could also be an allusion to the fact that human life is so rich, diverse, & interesting, but also extremely fragile. Someone who controls much power can, simply with the press of a few buttons, erase everything that thousands or millions of people had worked so hard on.

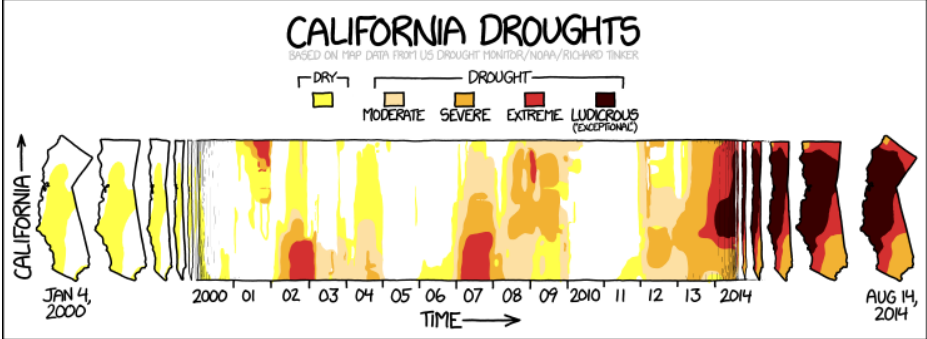
The drop table command was also used in 327: Exploits of a Mom, although with less fatal results.

The title text may suggest that when the people disappeared or "died", their records were moved to a table called "Ghosts". The query would then, presumably, see all the people that were deleted. In some implementations of databases deleted records are still hidden and remain until a "Ghost Cleanup Process" removes the data permanently; the title text may also allude to this process. Alternatively, the title text may refer to movies such as The Sixth Sense, in which certain people are ghosts, unbeknownst to those around them, another quality that may be elucidated by Megan's device.

## #1410: California

August 20, 2014

I LIKE HOW LONG AND SKINNY CALIFORNIA IS BECAUSE IT MEANS YOU CAN USE IT AS A GRAPH AXIS:



58% of the state has gone into plaid.

## Explanation

This graph shows the levels of drought over time in the state of California using years on the horizontal axis and distance along a 45 degrees rotated north-south-axis of California on the vertical axis. The image illustrates the use of the distance measure on the vertical axis by visually rotating and stacking multiple maps of California next to each other.

The geography of California lends itself well to this kind of graphical interpretation because the state is much taller than it is wide, hence, large-scale phenomena like weather patterns are likely to cover much of the "width" of the state but only part of the "height". Because the variation in the west-east direction will be small, a side-on view of the state can be used as the vertical axis in a graph, so that the indicated values are either the average or extreme value across the width of California.

Randall compiled the data in this graph from data from the US Drought Monitor, which is authored by Richard Tinker from NOAA. The colors Randall uses correspond to drought intensity levels D0-D4 defined on the Drought Monitor site.

The darkest, most severe level of drought is labelled "ludicrous" (causing laughter because of absurdity), but a parenthetical remark indicates that the official term is "exceptional.". Of course, with half or more of the state in this condition, it can hardly be called "exceptional" any



longer.

The graph shows that in 2000, 2005, and 2010, there were very little or no drought conditions in California, but that the intervening periods have seen increasingly severe droughts. According to the most recent data, the state is entirely in a condition of "severe" or worse drought, with "ludicrous" conditions across approximately half its area. The graph also reveals that 2014 is the first year (since 2000) where the "ludicrous" level has been seen. Indeed, a comic about drought is rather topical: California is in the middle of one of its worst droughts in recorded history.

The title text is a reference from the movie Spaceballs, a parody of various Sci-Fi movies. Lone Starr and Barf in their Winnebago space ship traveling at lightspeed are passed by Spaceball One, which is traveling at "ludicrous" speed. The path of Spaceball One is shown as a plaid pattern and Barf remarks "They've gone to plaid!" (YouTube clip).

## #1411: Loop

August 22, 2014



Ugh, today's kids are forgetting the old-fashioned art of absentmindedly reading the same half-page of a book over and over and then letting your attention wander and picking up another book.

## Explanation

Cueball is seen at his desk in front of four devices. He has clearly run out of things to do, or is looking for an excuse to procrastinate. A flowchart describes the process by which he scans the whole environment for something to do, which everyone can relate to.

The comic uses electronics likely because they are the common time killer these days, and are most likely to contain fresh, tantalizing entertainment. News sites can be viewed as a good source of yet-to-be-seen content. Yet the search yields no interesting content, or the results don't garner enough attention, thus the blank stares and moving on to next device in line. Cueball has four devices, so he can begin with the desktop and move through the loop three times - first to laptop, then tablet and finally to smartphone.

The title text notes that this also happened before there were electronic devices like today, assuming most entertainment came from books. The point made is that, while the Internet and modern electronic devices are often blamed for jeopardizing the minds of adolescents, the attention span of "the kids" is not worse than it ever was, neither in the context of low-tech nor high-tech media. Kids focus on some things for a long time, but they do change this focus often very abruptly. But nevertheless there are still many kids reading books today until the end.

The title text could also be considered to imply another type of loop in which various generations experience the same situations under different circumstances (i.e., history repeating itself). In this case, the new generation experiences the attention lapse loop with electronics, whereas the previous generation experienced this same loop with books. There may also be a commentary present on the shorter attention span of the current generation as opposed to the previous one in that there is an obvious terminus to the electronics loop while the book loop could extend nearly indefinitely.

# #1412: Teenage Mutant Ninja Turtles

August 25, 2014

**WIKIPEDIA ARTICLE TITLES**  
WITH THE RIGHT SYLLABLE STRESS PATTERN  
TO BE SUNG TO THE TUNE OF THE ORIGINAL  
TEENAGE MUTANT NINJA TURTLES THEME SONG

**ACE VENTURA: PET**

**DETECTIVE**

EDGAR ALLAN POE MUSEUM  
ENGINE FAILURE AFTER TAKE-OFF  
ENGLISH AS A SECOND LANGUAGE  
FORMER ARCTIC MONKEYS MEMBERS  
FOULERS' MODERN ENGLISH USAGE  
GEORGIA GAME AND FISH DEPARTMENT  
GOLDEN-MANTLED HOULDER MONKEY  
GREATER CLEVELAND FILM COMMISSION  
HAIRY FLOWER CHAFER BEETLE

**ASIAN HUMAN RIGHTS**

**COMMISSION**

HARLAND DAVID "COLONEL" SANDERS  
HUMAN TISSUE RESOURCE NETWORK  
KLONDIKE CLASS DESTROYER TENDER  
LEGAL CODE OF NORTH DAKOTA  
LESSER KNAPWEED FLOWER WEEVIL  
LOORHEED MARTIN ATLAS ROCKET  
MAPLE SYRUP URINE SYNDROME  
MIGHTY MORPHIN' POWER RANGERS  
NABBUS MASK-LIKE FACIAL SYNDROME

**SAN DIEGO CITY**

**COUNCIL**

NED GED POCKET COLOR  
NEW YEAR'S EVE WITH CARSON DALY  
NEWTON'S SECOND LAW OF MOTION  
NORTH KOREAN WORKERS PARTY  
ORANGE COUNTY BUSINESS COUNCIL  
OVER/UNDER CABLE COILING  
PETER PETER PUMPKIN EATER  
PLACES NAMED FOR ADOLF HITLER  
PROTON-PROTON CHAIN REACTION

**SINGLE PAYER HEALTH**

**INSURANCE**

PUERTO RICAN LIZARD-CUCKOO  
QUANTUM VACUUM PLASMA THRUSTER  
ROCKY MOUNTAIN SPOTTED FEVER  
ROYAL FLYING DOCTOR SERVICE  
RUSSIAN WOMEN'S FASCIST MOVEMENT  
SEMI-ACTIVE LASER GUIDANCE  
SEVEN BRIDES FOR SEVEN BROTHERS  
SHERLOCK HOLMES: A GAME OF SHADOWS  
SIX DEGREES OF KEVIN BACON

**SPOTTED GIANT FLYING**

**SQUIRREL**

TRAILING SUCTION HOPPER DREDGER  
VECTOR GRAPHICS MARKUP LANGUAGE  
VITI LEVU GIANT PIGEON  
VOTING RIGHTS IN PUERTO RICO  
WILLIAM HENRY, DUKE OF GLOUCESTER  
WINDOUS VISTA STARTUP PROCESS  
WOODROW WILSON "WOODY" GUTHRIE  
YABA MONKEY TUMOR VIRUS  
ZACK AND MIRI MAKE A PORN

**WOMEN SCIENCE FICTION**

**AUTHORS**

My upcoming album, 'Linked List', has covers of 'The Purple People Eater', the Ninja Turtles theme, 'Itsy Bitsy Teenie Weenie Yellow Polka Dot Bikini', and the Power Rangers theme, with every song played to the tune of the next.

## Explanation

This comic is a reference to the recently released Teenage Mutant Ninja Turtles movie. It is a list of Wikipedia article titles that are in the same syllable-stress pattern as the first line of the theme song of the 1987 cartoon series.

The list is compiled in alphabetical order from top to bottom, without respect to the left or right column. Some of the items on this list (e.g. Ace Ventura: Pet Detective) are drawn as headlines in the same style as the logo from that series. These articles are not in alphabetical order with the surrounding small face text, but these headlines are in alphabetical order with the other headlines from top to bottom, without respect to the left or right column. Some of these phrases are not actually the titles of Wikipedia articles, but are redirects. For instance, the article on Woodrow Wilson "Woody" Guthrie redirects to Woody Guthrie, and Former Arctic Monkeys members at one time redirected to Andy Nicholson.

The syllable-stress pattern of this line is long-short-long-short-long-short-long-short, known in poetry as trochaic tetrameter. Randall has previously authored comics dealing with trochees, namely 856: Trochee Fixation and 1383: Magic Words.

A similar idea was performed by Jimmy Fallon in 2001 at a concert for New York city where he demonstrated singing "any 80's song" over the tune of MC Hammer's

song "U Can't Touch This".

The title text suggests an album of songs (The Purple People Eater, the aforementioned Ninja Turtles theme, Itsy Bitsy Teenie Weenie Yellow Polka Dot Bikini and the Mighty Morphin' Power Rangers theme), the title or primary refrain of which have a large number of verses in trochaic meter. Randall suggests that these refrains are so interchangeable that the lyrics of each could be sung to the melody of the song following it in the tracklist. Randall would title the album Linked List as each song would melodically reference the next song. The refrains of the songs, respectively are:

- "One-eyed, one-horned flying purple people eater"
- "Teenage Mutant Ninja Turtles"
- "Itsy Bitsy Teenie Weenie Yellow Polka Dot Bikini"
- "Go go Power Rangers"

In 2019 a Twitter feed was created which identifies Wikipedia articles with this stress pattern and creates a matching graphic.

## #1413: Suddenly Popular

August 27, 2014

OBSCURE WORDS AND PHRASES EVERYONE SUDDENLY BECOMES VERY FAMILIAR WITH	
1995	← WORLD WIDE WEB ← DNA EVIDENCE ← MILITIA MOVEMENT ← SUPERMAX
2000	← BUTTERFLY BALLOT ← AL-QAEDA ← WI-FI
2005	← TSUNAMI
2010	← VIRAL ← RADICALIZE
2015	← METADATA ← LAHAR ← INSECT-BORNE
2020	← EARTH-CROSSING ← THERMOHALINE
2025	← SNOW BLINDNESS ← AMPLEXUS ← CONTROLLED HYDROPLANING
2030	← PARADOXICAL REACTION ← DRONE DESERTION ← RAPID HAIR GROWTH
2035	
2040	I SWEAR ALLEGIANCE ← TO THE GOD-EMPRESS IN LIFE AND IN DEATH

Are Your Teens Practicing Amplexus? Learn These Six Telltale Signs!



## Explanation

Many phrases that used to be of mainly academic interest become popular when an important event or global trend is described with such phrases in the media. Randall presents a timeline of past examples, and predicts phrases that may be popularised in the near future. The past events are a mix of buzz words and words that became popularized as a result of technology trends, natural disasters, or terrorism. The future events seem to be all related to natural disasters or other kinds of serious issues, except Amplexus — which is the joke of the title text — showing that no matter how many disasters there are, people are generally more concerned about their teenagers' sex lives.

The title text is also an example of a clickbait headline. Many organizations will post a link on social media to their content with a sensationalized headline in order to draw readers in. In this case, the headline is geared towards parents who are worried about their children being sexually active in this new Amplexus way. Such headlines are the internet's analog to television news' promos ("A new trend among teens is sweeping the nation, but is it dangerous? Details at 11:00.").

Global catastrophic risk is a theme throughout this comic. Randall predicts a large asteroid impact/near miss and a volcanic eruption, followed by an impact winter or volcanic winter. An insect borne, global pandemic without a cure also strikes, and then the technological

singularity occurs.

This comic has similar features to 887: Future Timeline.

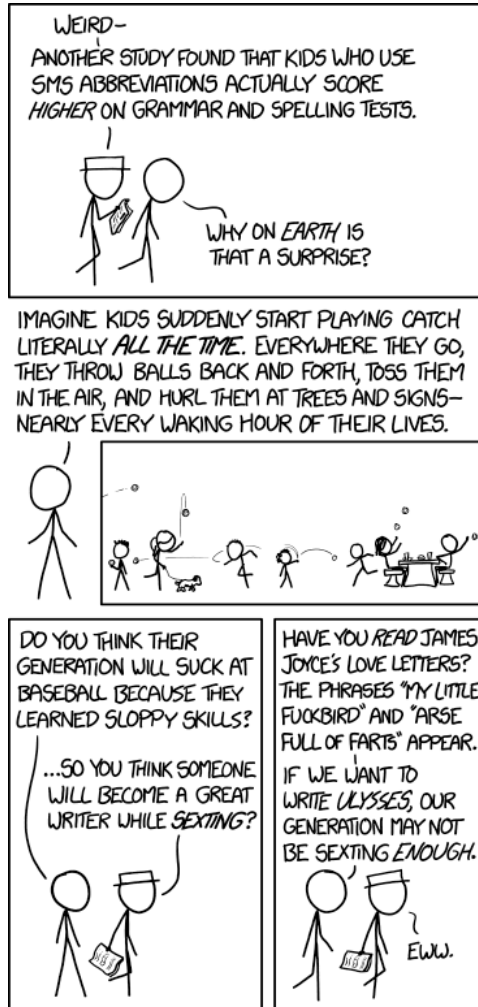
### **List of the phrases[edit]**

Below the phrases are listed with the closest year from the time-line noted behind the phrase. Note that this year does not necessarily match with the in-real-life relevant year. This may be found in the explanation of the phrase below. Google Books Ngram Viewer can show the relative frequency of those words in function of the year.

From this point on, phrases were in the future at the time of publication.

## #1414: Writing Skills

August 29, 2014



I'd like to find a corpus of writing from children in a non-self-selected sample (e.g. handwritten letters to the president from everyone in the same teacher's 7th grade class every year)—and score the kids today versus the

kids 20 years ago on various objective measures of writing quality. I've heard the idea that exposure to all this amateur peer practice is hurting us, but I'd bet on the generation that conducts the bulk of their social lives via the written word over the generation that occasionally wrote book reports and letters to grandma once a year, any day.

## Explanation

Cueball and White Hat are discussing the positive and negative effects of young people writing on mobile phones in the vernacular of the day, Short Message Service (SMS). SMS messages are one of the primary means of text communication on mobile devices, and are typically limited to 160 characters. Due to the limited space available on this and other messaging platforms, and also to decrease the time taken to write a message, SMS language (aka textese) developed as a form of short-hand writing. This involves the abbreviation and deliberate misspelling of words, and the use of acronyms.

Naturally, the use of this style of language has expanded into other areas, including those where brevity is not an issue, and this expansion and evolution of language is a subject of intense debate. The main viewpoints on the subject are:

- Language is being negatively degraded by the use of text speak
- The use of text speak is a natural evolution of language

Cueball's point is that "practice makes perfect". The ability to form good grammar comes from practice through a lot of writing, even when that writing is informal; hence, the SMS generation gets a lot of practice compared to previous generations, who communicated mostly with speech, over the phone, and in person, and may have written only a few letters a year. To foster

talent for a major literary work, we should encourage practice, even when that practice is through informal writing such as SMS.

This idea has some real scientific background, such as the 2009 investigation Exploring the relationship between children's knowledge of text message abbreviations and school literacy outcomes. In this study children 10-12 were asked to compose text messages. The number of textisms was recorded, and a positive correlation was found between use of SMS abbreviations and success at literacy tests. This is then related to David Crystal's concept of "ludic" language: the playful use of language as a contribution to language development. That notion is developed here: By playing with textual language, one develops writing skills, just as by playing with balls one can develop sports skills. David Crystal explains: "Children could not be good at texting if they had not already developed great literary awareness [...] If you are aware that your texting behavior is different, you must have intuited that there is a standard."

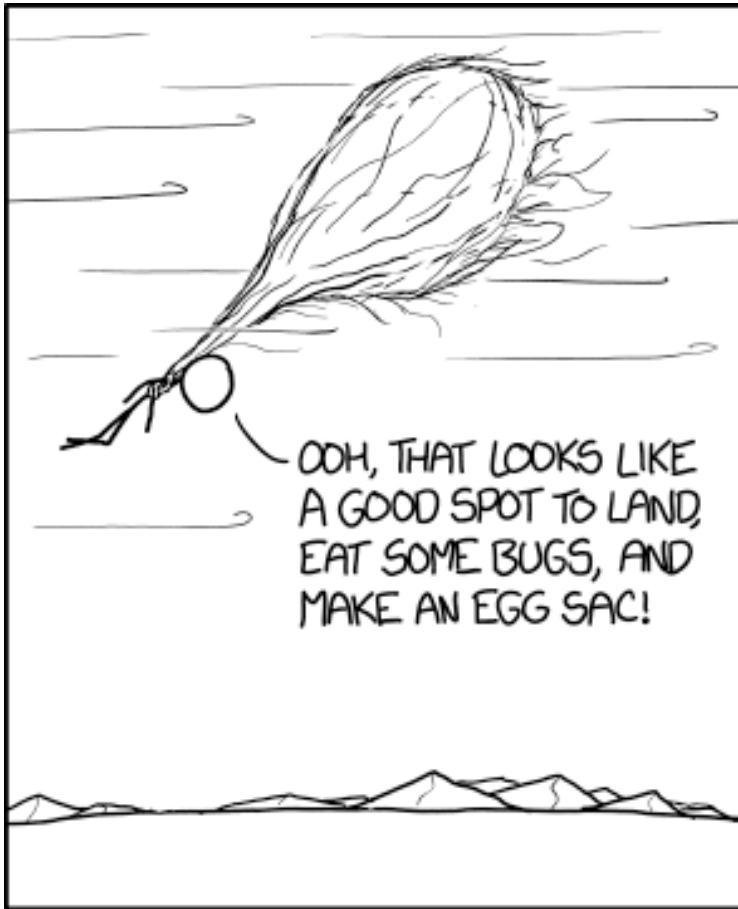
James Joyce was a celebrated Irish novelist and poet, and his novel *Ulysses* is considered to be one of the most important works of modernist literature. It was criticized in some quarters for the frequent lack of punctuation and ungrammatical stream of consciousness narrative mode. In addition to his better-known works, he wrote a number of love letters with extremely explicit content.

In the title text, Randall wishes to prove Cueball's point by analyzing and comparing bulk volumes of texts (= a

corpus) written by children today and 20 years ago. Randall favors the literary ability of today's children for their everyday use of written word over the situation of the past, when children wrote only if forced to do so. The title text's second sentence is particularly long and complex (compared to almost any other title text), which will generally score much higher "on various objective measures of writing quality". Randall may be hinting that writing a lot of short title texts, like writing a lot of SMSs, improves your general writing quality - further strengthening Cueball's point. The title text is also 99 words long, probably referencing a 100 word limit.

## #1415: Ballooning

*September 01, 2014*



♪ SPIDER-MAN, SPIDER-MAN,  
DOES WHATEVER A SPIDER CAN ♪

Time to dance in front of Mary Jane! If I'm lucky, she'll turn out not to practice pre-copulatory sexual cannibalism!



## Explanation

Spider-Man is a fictional superhero in comic books published by Marvel Comics, and has been the star of a number of television shows and film. The Spider-Man theme song, first used for the 1967 cartoon show, includes the words, "Spider-Man, Spider-Man, does whatever a spider can". However, at other points, the theme song explains some things Spider-Man can do that a real spider obviously couldn't, such as crime-fighting.[citation needed] Randall is pointing out that while the abilities attributed to Spider-Man make a good superhero story, they are not real abilities of a spider.

This comic depicts Cueball as a far more realistic Spider-Man, behaving and thinking much more closely to a real spider than the Spider-Man from the comics. Cueball is shown ballooning (example), a trait used by spiders to move between locations, rather than swinging on web cords as in the comics and films. As he is floating, he sees a good spot to land, eat some bugs and make an egg sac. Again this contrasts the real life of a spider with Spider-Man, who would doubtless be rushing to fight crime or save a pretty girl.

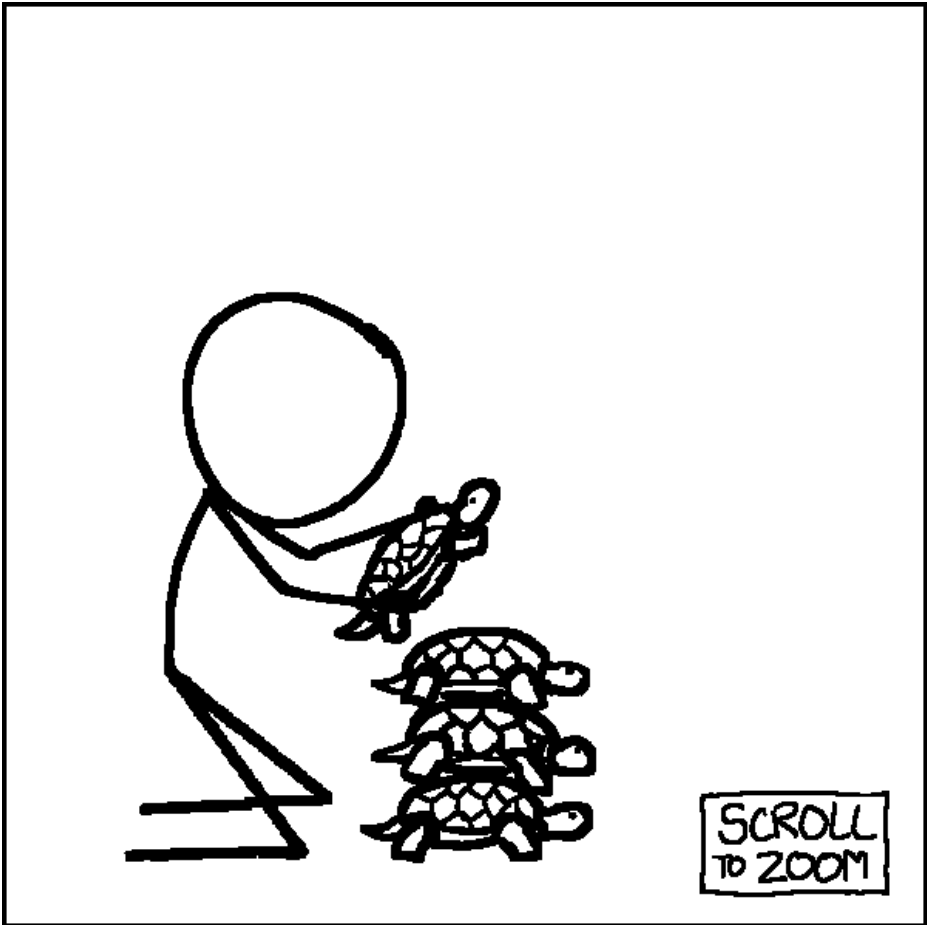
Only female spiders create an egg sac. Male spiders spin a sperm web in order to transfer their sperm from their epigastric furrow into their pedipalps (reproductive organ located on the front two appendages, in the position where a scorpion would have pincers), which

will then be used to transfer the sperm into the female during copulation. Cueball/Spider-Man, being nominally male, should in fact be looking for a place to create a sperm web, not an egg sac. However, thanks to being featured in children's books, the actions of female spiders are much more widely known.

The title text refers to the mating ritual of some spiders, in which the male performs a dance to court the female. Mary Jane Watson is the third love interest and Peter's eventual wife in the Spider-Man stories, and so Cueball is planning to court her by dancing in front of her. In doing so he hopes that he is lucky, and she doesn't eat him before copulating with him, as sexual cannibalism is a trait associated with spiders.

## #1416: Pixels

*September 03, 2014*



It's turtles all the way down.

## Explanation

This interactive comic begins with a panel where Cueball is stacking turtles. This is a reference to the idiom "turtles all the way down", which refers to the problem of infinite recursion: if everything in the universe is "on top of" something else, so to speak, there must be a "bottom." A joking solution to the paradoxical nature of such a bottom is the proposition that the world rests on a semi-infinite stack of turtles.

The origins of the turtle story are uncertain. It has been recorded since the mid 19th century, and may possibly date to the 18th. One recent version appears in Stephen Hawking's 1988 book *A Brief History of Time*, which starts:

Several ancient myths, dating back thousands of years, involve a turtle which supports the whole world, or a part of it, although it is usually just one turtle, not an infinite regression. This is also repeated in Terry Pratchett's *Discworld* novels, in which the world is supported by four elephants standing on the back of a single turtle called Great A'Tuin.

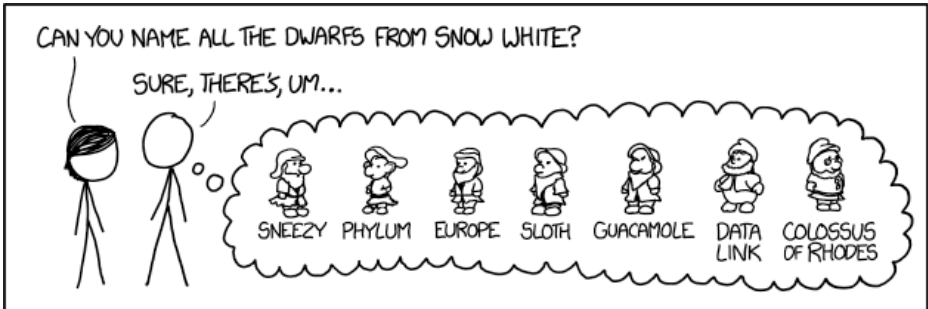
As can be read you should "scroll to zoom". This can be done by placing the cursor inside the panel of the comic. When scrolling up (using the mouse wheel) the picture zooms in on the pixel beneath the cursor. Moving the cursor will also move the point to which the picture zooms. You can then zoom in until the pixels are visible.

When you continue to zoom in on a pixel it then resolves into another comic picture, with black-on-white comic panels making up the white pixels and white-on-black panels making up the black pixels. Scrolling on until you can see the pixels of the comic picture you are now zooming into the process is repeated again and will be so for all subsequent sets of comic panels. Not all white and all black panels are the same; some sets involve more than two different panels, but all involve repetitive tiling.

Once you have zoomed in, you are able to click and drag the picture, thus enabling you to move from black to white picture pixel. This is reminiscent of the earlier interactive comic 1110: Click and Drag.

## #1417: Seven

September 05, 2014



I HAVE THIS PROBLEM WHERE ALL SETS OF SEVEN THINGS ARE INDISTINGUISHABLE TO ME.

The days of the week are Monday, Arctic, Wellesley,  
Green, Electra, Synergize, and the Seventh Seal.

## Explanation

In this comic, Cueball (or perhaps Randall) says he can't distinguish between sets that have exactly seven objects. This leads him to exchange the items in the sets without noticing, to the point where, when attempting to list a single set, each item mentioned actually belongs to a different set.

This is shown in the comic when Megan asks Cueball to name the seven dwarfs from Snow White and the Seven Dwarfs, a task some people might find difficult, although they would not just choose words from other sets of seven to fill in the gaps.

The title text reveals that even a trivial set of seven items, like the days of the week, also goes completely wrong.

The comic may be related to the oldest set-theoretic definition of the natural numbers, in which for each natural number, an equivalence class is defined over all sets which contain the same number of items. As Cueball is known for mathematical thinking, he could be presumed to have taken the underlying equivalence relation to heart, and (over)applying it to real life, genuinely judging sets to be identical if they all contain  $N$  objects.

The number seven being the number for when sets become indistinguishable is possibly a reference to Miller's law. Especially considering that this is a law

dealing with human memory, which Cueball is having issues with. However, this law refers to elements within the same set becoming indistinguishable, rather than the indistinguishability of different sets of the same size - indeed, its original tests involved either distinguishing between the items, or repeating them back in the correct order. But then again, that might be part of the humor.

The number seven has culturally been regarded as a special, magical or holy number, which contributes to the large number of familiar sets of seven that make this comic possible. This proliferation of well-known sets of 7 items could be another reason why Randall chose to use the number seven in the comic.

In 1554: Spice Girls the game continues with Cueball saying that it is now Megan's turn and then he asks her a similar question regarding the names of the Spice Girls. Her problem is then that she simply finds different sets of five and then just adds Spice behind each of the words of that set.

### **Comic list[edit]**

For each of the seven lists below, the relevant item's traditional position within its own list of seven, according to Wikipedia, is not necessarily equal to its position on the list in the comic. For some lists the position is equal, but not for all. For instance Sneezy is traditionally never mentioned first amongst the dwarfs since the leader Doc normally comes first. But "phylum" is the second major taxonomic rank as is "phylum" the second item on the list in the comic.



The seven "dwarfs" mentioned and their relevant sets of seven are (items in the set are written in bold):

### **Title text list[edit]**

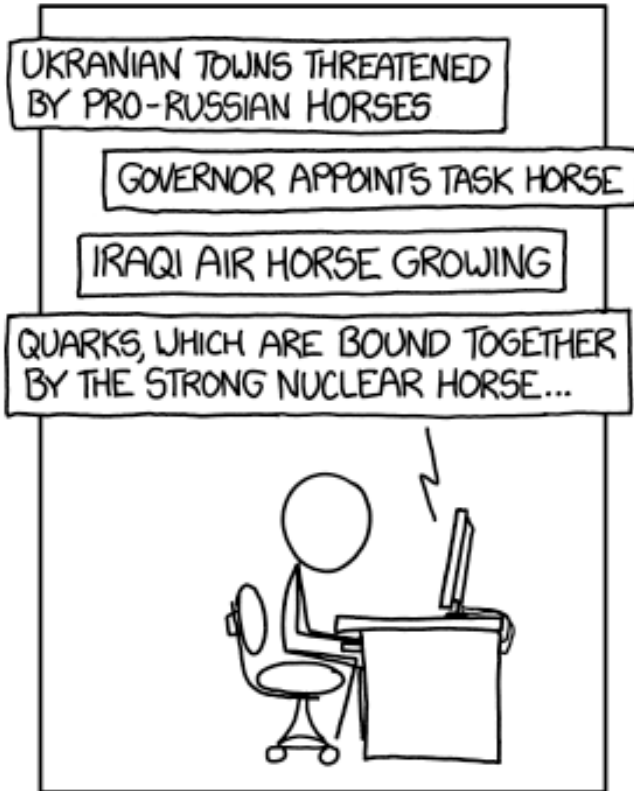
The title text extends this saying he also does the same with the set of the seven days of the week. There are several sets of 7 featuring the name Electra, which are all listed in the table below. Until Randall tells us which he meant, all are possible.

The sets Cueball's "days of the week" come from are:

## #1418: Horse

September 08, 2014

NEW FAVORITE  
BROWSER TEXT REPLACEMENT:  
**FORCE → HORSE**



Officer suspended from horse.

## Explanation

Cueball has set his browser to auto-replace the word "force" with the word "horse." Some of the humorous resulting news headlines are shown.

- Ukrainian town threatened by pro-Russian horses

At the time this comic was published, there was civil unrest in Ukraine, mostly framed as pro-European vs pro-Russian. In earlier centuries, the phrase "pro-Russian horses" could refer to the animals ridden by Cossacks, or by their enemies, as alliances shifted.

In 2022, this statement would perhaps become even more relevant.

It should be noted that Randall spelled "Ukrainian" incorrectly, forgetting the first 'i'.

- Governor appoints task horse

A Task force is a unit or formation established to work on a single defined task or activity, which makes it quite comical to picture a horse instead of a unit. A "task horse" would presumably be a horse performing tasks.

- Iraqi Air Horse growing

The Air Force of Iraq may indeed be being up-armed, especially in light of the threat, at this time, of ISIS/ISIL/Islamic State forces across swaths of both Iraq and Syria. In mythology, Pegasus was a winged horse

that could fly through the air, and might be considered an "air horse". In real life, "Air Horse One" is an airplane equipped for transporting horses.

- Quarks, which are bound together by the strong nuclear force...

Quarks are elementary particles. They form bound states e.g. the proton (two up + one down-quark) mediated by the strong force, similarly as atoms are bound states of electrons and charged nucleons held together by the electromagnetic force.

They are also referenced in 474: Turn-On, 1621: Fixion and in 1731: Wrong.

There is a real Nuclear horse in a different sense, which is a racehorse born in 2017 and named Nuclear.

- Officer suspended from horse (title text)

Being suspended from a police force (i.e. usually being forced upon mandatory leave pending resolution of the issue at hand; paid, part-paid or unpaid) is a common practice where culpable wrongdoing of sufficiently serious nature is suspected of the individual concerned. It may also occur in some countries when the police officer grew too old for the job. A person could literally be suspended from a horse if they fall off the horse but got stuck in the stirrups. Unlike most of these "horse" terms, a police horse is a real thing.

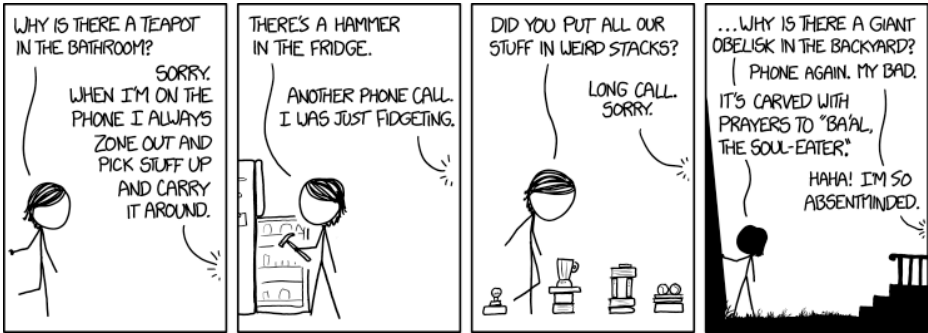
This is probably a parody of the Cloud to Butt Chrome Extension (since it says new favorite browser text

replacement).

There has been several comics using substitutions before and also at least one after this one.

## #1419: On the Phone

September 10, 2014



'No idea what I was thinking! Haha! But anyway, maybe we should check out what this Ba'al guy has to say.'

## Explanation

Fidgeting while talking on the telephone is a very common habit and may manifest as doodling or pacing. In the case of the person speaking off-panel (presumably Cueball), he paces while absent-mindedly moving random objects around the house.

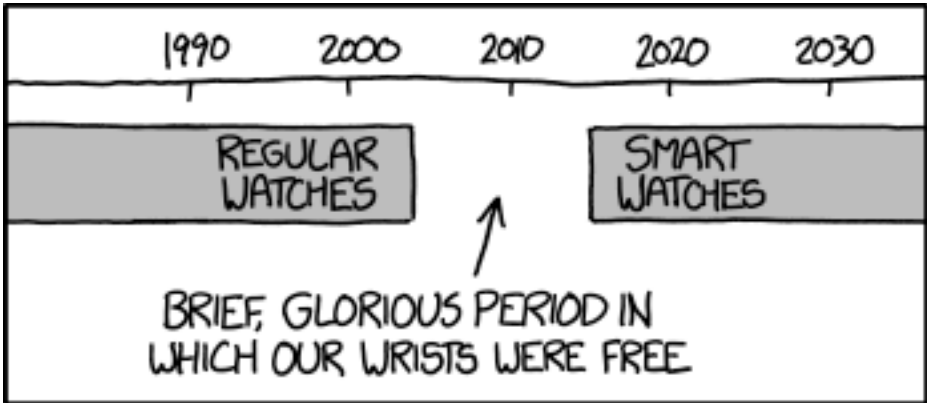
Megan has found several items in incorrect places around her house, including a teapot in the bathroom, a hammer in the fridge, and several stacks of household items. Cueball explains that he fidgets and move things around while on the phone. Taking this behavior to the extreme, in the fourth panel, Megan finds that he has also erected an obelisk in the backyard and carved prayers to "Ba'al, the Soul Eater" on it. This may be a reference to the saying "Idle hands are the devil's playthings."

The title text suggests that the "fidgeting" is just a cover story - the off-panel speaker is actually worshipping (or being possessed by) Ba'al, and is casually trying to encourage Megan to do the same. Either that or Cueball is genuinely curious about Ba'al and what he has to say.

Ba'al, or Baal, refers to one of many deities and demons which go by this name. Given its title "The Soul Eater", it probably refers to Beelzebub (one of the seven princes of hell). Ba'al, the Soul Eater has been mentioned in 1246: Pale Blue Dot and 1638: Backslashes.

## #1420: Watches

*September 12, 2014*



Old people used to write obnoxious thinkpieces about how people these days always wear watches and are slaves to the clock, but now they've switched to writing thinkpieces about how kids these days don't appreciate the benefits of an old-fashioned watch. My position is: The word 'thinkpiece' sounds like a word made up by someone who didn't know about the word 'brain'.



## Explanation

This comic coincides with the announcement of a new smart watch by Apple earlier in the week as of the comic's release date (9th Sept 2014), the Apple Watch, along with a large emphasis on smartwatches at IFA 2014 (Sept 5-10), particularly 'Android Wear'.

The timeline shows a period approximately from 2005 to 2015 where our wrists were liberated from the tethers of wearing a watch, likely attributed to the fact that many instead used a mobile smartphone to tell the time.

Whilst other smartwatches have been released in the past, Randall predicts that the typical widespread interest following Apple product releases (combined with many other new releases by other companies) will result in our wrists again being shackled in the grip of watches from 2015. The wording of the label suggests that Randall is pre-emptively mourning the imminent loss of freedom of his and others' wrists, though this may be humorous hyperbole/sarcasm, as his position has generally been of apathy, such as in 1215: Insight.

The title text refers to how "old people" tend to express derision towards change (generally most widely accepted by 'young people') as not being like it was "in the good old days", even if this means they contradict themselves. Initially, the wearing of watches was viewed negatively by the older generation, but now not wearing a watch is instead negative. The second part of the title text starts as

if Randall is going to express an opinion on wearing a watch but then veers off to mock the word "thinkpiece," due to its (particularly recent) connotation for lacking factual content and expressing biased opinions. For more details on thinkpiece see this article. By equating thinkpiece with brain, Randall is making a reference to the fact that this compound word does not follow the convention of the compound word timepiece, which is a synonym for watch.

## #1421: Future Self

September 15, 2014



Maybe I haven't been to Iceland because I'm busy dealing with YOUR crummy code.

## Explanation

This comic is a joke about how the person you were in the past can be viewed as a distinct entity from who you are now, as well as the predictability of future events relating to your future actions.

The comic shows comments, informational notes left in the code that do not change the algorithm, from a project completed by Cueball some time ago that is still being used and maintained. It is implied that Cueball is looking at these comments because the algorithm, a parsing function, is no longer working. These comments were written by Cueball's "younger self" in anticipation of being read by his "older self" at a date close to the present. The function has held up to the younger Cueball's expectations as it has lasted until the publication date of this comic, September 2014. The comments indicate a firm belief that the parsing function could not be easily "re-kludged" to handle the new situation but instead would need to be re-written.

These comments are surprisingly accurate, leading Cueball to rhetorically reply to his younger self that these comments were creepy. Cueball's "younger self" must have anticipated a snarky reply and reminded his older self that his older self has likely not fulfilled his dream of going to Iceland. Cueball again replies that his younger self should stop judging him.

In the title text, current-day Cueball lashes out at his younger self, further emphasizing the way he is viewing

his past self as a different person, blaming the ineffectiveness of his past self's coding for never going to Iceland, even though the effectiveness of his past code has no correlation with being able to travel, unless he had to fix the code for a project, ruining the time space he had to travel, or his code helped him plan his trips.

A comment is a line, or a portion of a line, of code which should not be executed. A number of computer languages, including Python, use "#" to indicate "the remainder of this line is a comment". The comment symbol tells the compiler to skip to the next line, ignoring everything after the symbol. Programmers make use of comments to leave notes about what a particular line or section of code is meant to do, places that require debugging, ideas for future revisions, etc.

The language in the comments is similar to how people address themselves in personal time capsules, in which they put letters away to read years later to see how much they've changed.

A "parse function" is code that interprets some form of input and makes sense of it in a way that enables functionality in some other part of the code. Parsers are commonly used to extract useful information from a source external to the algorithm.

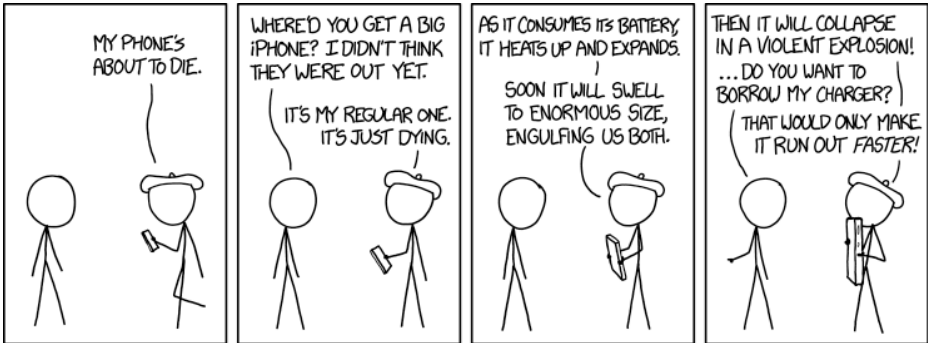
Often parsing functions are written using regular expressions or in some other write-only language style. Parsing can be a difficult problem to solve, and programmers will often take shortcuts (perform kludges)

based on assumptions on the kinds of input that the parsing function will have to handle, or possibly code through means of trial-and-error.

As the programmer may not have control over the input, such as reading a page from someone else's web-site or using the output of an unpredictable program, an input that does not match the assumed input syntax in can cause the parser to break, even if the parsing function has not changed.

## #1422: My Phone is Dying

September 17, 2014



When it explodes, it will cast off its outer layers, leaving behind nothing but a slowly fading PalmPilot, calculator, or two-way pager.

## Explanation

Beret Guy's phone is about to "die". Cueball assumes this just means that the battery is running out and it needs to be recharged, but the phone in question appears to "die" in a way analogous to the life and death of a star: expending its fuel while heating up and expanding before ultimately losing its outer layers and becoming a white dwarf or similar "lesser" star. The technology of mobile phones can be seen as doing things analogous to this on a large scale, especially for people who used landlines before mobile phones became common. This is something phones usually don't literally do, although there is a failure mode where the battery continues to expand, which can burst the rest of the phone apart.

In part because stars are really hot,[citation needed] stars constantly undergo fusion reactions. The pressure generated by these reactions counteracts gravity, preventing it from collapsing the star during its main lifespan. As the hydrogen mostly fuses into helium in the core, the core gradually becomes more dense and the region of fusion gradually moves away from the center. Then, the star grows in size, reaching the stage of a red giant. When most of the "fuel" for fusion has been consumed, gravity will collapse the star into a white dwarf while the outer layers are shed. For stars much more massive than the Sun, there will be a supernova explosion caused by a violent collapse, which is very powerful (and leaves behind a neutron star or a black hole, depending on how much mass is left after the



supernova). Stars with more hydrogen fuel tend to burn brighter and faster. Beret Guy's refusal of a charger is probably a reference to this.

Both a supernova explosion and the collapse of red giants into white dwarfs shed their outer layers, which is referenced in the title text. Once extra mass is added to the dying star, analogous to "charging", the process only accelerates. (Randall also explains this in Short Answer Section.) The phone seems to have a certain mass because Beret Guy expects it to go (super)nova. Charging the phone may lead to a type 1a nova.

The comic also plays on the release of two new iPhone models with bigger screens, planned for 2 days after the release of the comic.

The comic could be also explained by the characteristics of Li-ion batteries, which are used in most cellphones. At the end of their useful life, these batteries may grow a bit. In case of severe physical or thermal damage or multiple electrical failures, this type of battery can indeed overheat, leading to a thermal runaway reaction inside. That would result in the battery growing and eventually exploding. Connecting a charger to a battery failing in this manner would probably make the process faster.

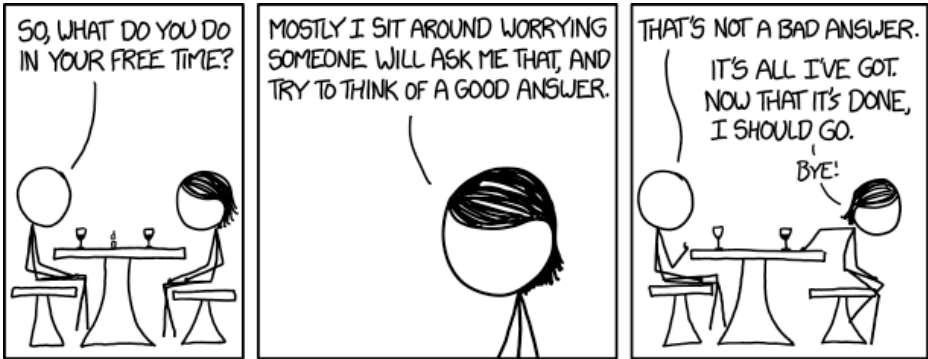
The title text implies that after Beret Guy's iPhone goes (super)nova, it will become either a "slowly fading" Palm Pilot, a calculator, or a two way pager: this would be the cellphone equivalent of a white dwarf (evidenced by the faint and slowly fading glow), neutron star, or black hole

(evidence: black holes emit "information" in the form of Hawking radiation and have at one time been suspected to be half of a two-way portal through spacetime, along with a "white hole").

Additionally, some particles and atoms decay by breaking into smaller, more elementary particles. It may be humorously implied that a PalmPilot (an early personal data assistant and precursor to the smartphone), a calculator (a very simple electronic device), and two-way pager (a device for sending and receiving short text messages) are the more elementary components that make up an iPhone.

## #1423: Conversation

*September 19, 2014*



Later, at home: 'Dear diary: Still can't figure out what to write here ...'

## Explanation

Cueball and Megan are on a first date and Cueball is trying to strike up a conversation by asking Megan what she does in her free time. Megan has probably been dreading this question, because she answers that her free time activity consists of trying to figure out how to respond if asked what she does in her free time. Cueball answers soothingly, but Megan's anxiety gets the better of her and she leaves abruptly.

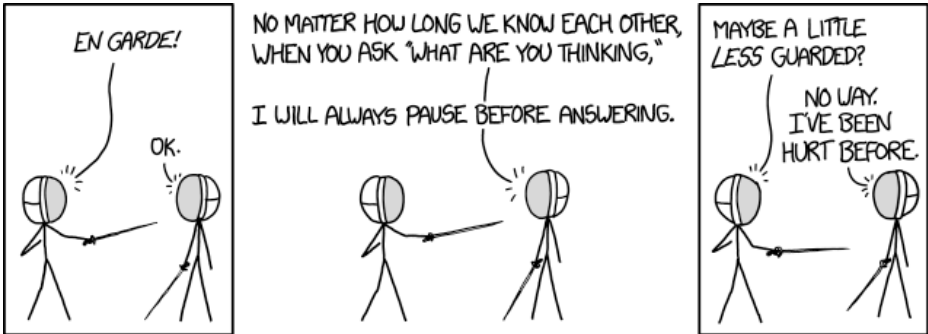
During Megan speaking, Cueball finished all of his drink. He may have been surprised by the reply, and Megan sensing this contributes to her leaving.

The title text implies that she also spends her free time wondering what to write in her diary (with no success).

Both the comic and the title text are examples of self-referential humor. Megan recognises that she spends her free time thinking what to say about her free time, so she must spend some of that free time thinking about her thinking about her free time. Such self-referential loops are often disturbing, since they contain within them potential for infinite regression. On the other hand, there is a simple way to exit the loop before any recursion: Megan has already decided what to say when asked what she does in her free time, and she has figured out what to write in her diary. But on realising this, Megan would have to find something else to occupy her free time, such as going on a date.

## #1424: En Garde

*September 22, 2014*



'Touch!' 'Nope, I sighed and stared at you with resignation, so I regained emotional right-of-way.'

## Explanation

Two Cueball-like guys are preparing to fence. But only the left seems ready. He says "en garde!", hence the title, a fencing call literally meaning "be on your guard" (from French). The call is used to order the participants to take their position, in a similar way to the "on your mark" command in racing. The other two commands are "[tireurs, êtes-vous] prêts?" ("[combatants, are you] ready?") and "allez" ("go"). The right participant takes this to mean being "guarded" emotionally.

"What are you thinking?" is a common question used to deepen a conversation, typically between close friends or lovers. The person being asked may take a moment to consider what they are thinking and whether or not it would be appropriate to share with the asker. If the person being asked is emotionally comfortable with the asker, they may answer immediately without fear of judgment or ridicule. Such a level of comfort between two people generally takes a long time to develop.

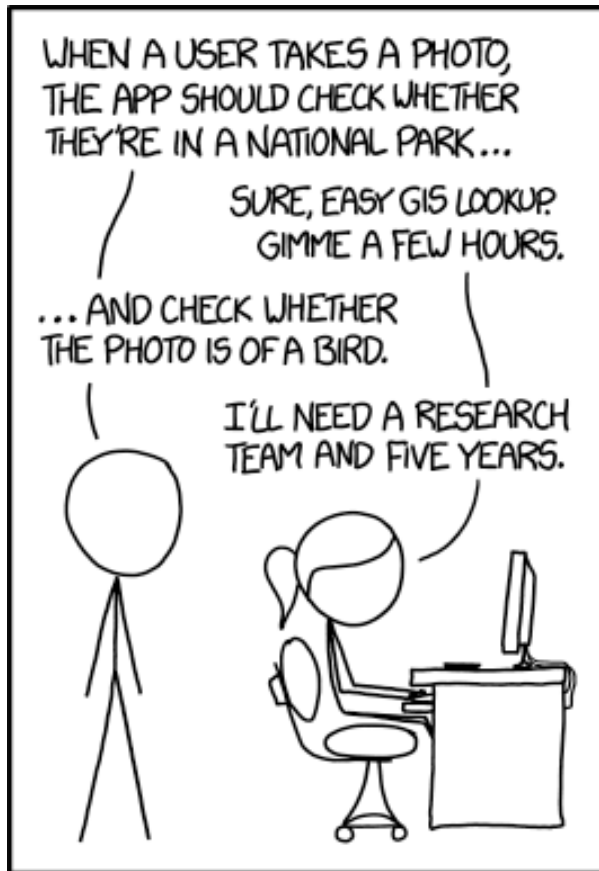
After the right fencer has explained why he is always "en garde", the left fencer asks if could be a little less so. But the answer is no since the right fencer acknowledges that he has been hurt before, and thus makes it even more difficult for him to let down his guards. Obviously the right fencer has had bad experience from previous relationships, maybe one where he was ridiculed after sharing his immediate thoughts.

The title text takes this further with the "touch" call, used to indicate to a participant that they have been "touched" by their opponent's blade, and therefore the attacker receives a point. The right participant counters this claim by saying his emotions have "priority" (or right-of-way), implying he was blocking out ("parrying") the touching feelings. Fencing right-of-way rules can make a move invalid when another move has priority, but generally refer to physical actions on the participant's part.

All in all it seems like the right fencer may be Black Hat.

## #1425: Tasks

September 24, 2014



IN CS, IT CAN BE HARD TO EXPLAIN  
THE DIFFERENCE BETWEEN THE EASY  
AND THE VIRTUALLY IMPOSSIBLE.

In the 60s, Marvin Minsky assigned a couple of undergrads to spend the summer programming a computer to use a camera to identify objects in a scene. He figured they'd have the problem solved by the end of the summer. Half a



century later, we're still working on it.

## Explanation

Cueball appears to be asking Ponytail to write an app that determines if a given picture is (1) taken in a national park, and (2) a picture of a bird. The first question is generally harder for a human to answer, but easy for an app that has access to location information and a geographic information system (GIS). The second one is easy for a human but much harder for a computer. This illustrates Moravec's paradox from the 1980s in a modern context. By the 1950s computers were useful for tasks like trajectory optimization, generating novel mathematical proofs, and the game of checkers, so such high-level computation and reasoning tasks that were hard for humans turned out to be relatively easy for them. On the other hand, it turns out to be hard to "give them the skills of a one-year-old when it comes to perception", as Moravec wrote.

In order to determine whether the user is in a national park, Ponytail plans to determine the user's location using the mobile device. This location will then be cross checked with a geographic information system (GIS) which will be able to determine whether the coordinates lie within a national park boundary.

Determining whether an image is of a given kind of natural object is far more difficult. This task falls into the area of computer vision. One of the goals in computer vision is to detect and classify objects within an image. This is a very challenging task for a number of reasons.

Firstly, humans use size, edge-assignment, movement, and stereoscopic vision when looking at a scene (not a picture of a thing, but the thing itself) to discern individual objects and then categorize them as foreground or background. A photograph, however, is a static, monoscopic image that can only provide size and edge-assignment clues. Humans are only able to discern objects from background in photographs by comparing the photo against all of the things they've seen and everything they've learned about those things over the course of their life and identifying matching patterns.

Secondly, the quality of the photograph will have an impact on a computer's ability to match patterns. For example, the object in the photograph might be partially visible or occluded. In the case of a living bird, additional complications arise from the variations among individual birds of the same species and differences in pose (flying, perching in a tree, etc.). Differentiating between visually similar objects can result in false positives. For example, is it a photo of a bird in flight or a plane (or superman!)? Ponytail's estimate of 5 years may be overly optimistic (see 678: Researcher Translation).

The state-of-the-art algorithms for solving this kind of task (as of this comic's publishing) use local features (e.g. SIFT or SURF in combination with a support vector machine) or a convolutional neural network.

The subtitle refers to "CS", which is a common abbreviation for "Computer Science", of which artificial intelligence and computer vision are sub-disciplines.

The title text mentions The Summer Vision Project and Marvin Minsky of MIT. In the summer of 1966, he asked his undergraduate student Gerald Jay Sussman to "spend the summer linking a camera to a computer and getting the computer to describe what it saw". Seymour Papert drafted the plan, and it seems that Sussman was joined by Bill Gosper, Richard Greenblatt, Leslie Lamport, Adolfo Guzman, Michael Speciner, John White, Benjamin, and Henneman - in case the multiple Wikipedia links don't give it away, know that this is a sizable cross-section of the AI researchers of the period. The project schedule allocated one summer for the completion of this task. The required time was obviously significantly underestimated, since dozens of research groups around the world are still working on this topic today.

A month after this comic came out, Flickr responded with a prototype online tool to do something similar to what the comic describes, using its automated-tagging software. According to them, the bird solution "took us less than 5 years to build, though it's definitely a hard problem, and we've still got room for improvement".

Now, years later, the second problem of detecting birds (or any other objects) in the image has also turned into a relatively easy application of existing technologies. There now exist both open- and closed-source image classification neural networks, after many groups have put in the years of research (with teams of computer scientists) into the problem of computer vision, and thanks to recent breakthroughs in neural net

architectures.

## #1426: Reduce Your Payments

*September 26, 2014*



I tried oxidizing them, but your bank uses some really weird paper and it wouldn't light.

## Explanation

Black Hat walks into a room where Cueball sits in an armchair. Black Hat says to Cueball that he can reduce his mortgage payments, while holding a docket of paper, presumably Cueball's payment check, that looks like it has been dipped into a liquid of some kind. Black Hat uses the same formulation many Internet advertisements use: "Discover this (strange/new/amazing...) trick to (lose weight/reduce your mortgage payments/meet amazing women...)" known as clickbait. Cueball wants to know how and Black Hat responds by mentioning sodium borohydride ( $\text{NaBH}_4$ ). Since Cueball fell for Black Hat's bait he exclaims, "I hate you."

Sodium borohydride is a strong reducing agent, meaning in a chemical reaction it will "reduce" another substance. It is in fact used during the manufacture of paper, in order to bleach the natural color from the pulp and improve the resulting paper's brightness, opacity, ink-absorption, and strength (among other properties).

This comic is a typical switcharound pun. Cueball expects the value on a bill paid to be reduced, while Black Hat uses the chemical meaning of reducing, which would result at a minimum in the bleaching of all ink from the bill therefore making it unreadable.

The complementary chemical reaction to reduction is oxidation (mentioned in 1693: Oxidation), which is what happens if the paper mortgage payment is burned, as

referred to in the title text. They go together in redox reactions, which generally involve electron transfer from the chemical species which is oxidized to the one which is reduced. In that case, the pun about light (to start a fire) is that a reduced financial weight may seem light (not heavy). However, some forms of paper - particularly those used for things like receipts - possess a slight coating that limits their flammability. Cueball's statements appear to be made with such a paper, thus preventing Black Hat from burning the statements.



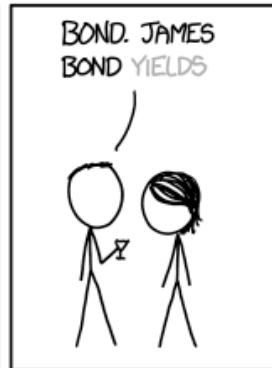
# #1427: iOS Keyboard

September 29, 2014

## MOVIE QUOTES



ACCORDING TO iOS 8 KEYBOARD PREDICTIONS



More actual results: 'Hello. My name is Inigo Montoya. You [are the best. The best thing ever]', 'Revenge is a dish best served [by a group of people in my room]', and 'They may take our lives, but they'll never take our [money].'

## Explanation

It looks like Randall has been playing with his Apple device after installing the recently released iOS 8 update. The comic is referencing the autocomplete function on the iOS virtual keyboard. A comparable feature is also available on other operating systems, like Android. When the phrase, for example, "Revenge is a dish best served" is typed, the keyboard will suggest "by" followed by "a" then "group" and so on.

The top of the comic, where the keyboard is shown, is a reference to the character Sherlock Holmes, a detective who is often attributed the famous line "Elementary, my dear Watson" (despite having never said that in the canon). In Randall's typing history, the word "dear" is most often followed by "lord", "friend", or "friends," and thus the phone suggests those words as a likely continuation of the line.

The title text continues, by showing more actual results from keyboard predictions from other movie quotes.

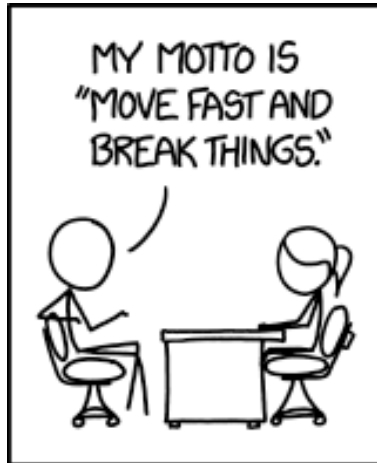
The following movies are referenced in the comic and title text:

An older comic 1068: Swiftkey is also about keyboard predictions, but without any preceding text (by the Swiftkey keyboard application instead of the iOS 8 keyboard).

It is similar to 2169: Predictive Models.

## #1428: Move Fast and Break Things

*October 01, 2014*



### JOBS I'VE BEEN FIRED FROM

FEDEX DRIVER  
CRANE OPERATOR  
SURGEON  
AIR TRAFFIC CONTROLLER  
PHARMACIST  
MUSEUM CURATOR  
WAITER  
DOG WALKER  
OIL TANKER CAPTAIN  
VIOLINIST  
MARS ROVER DRIVER  
MASSAGE THERAPIST

I was almost fired from a job driving the hearse in funeral processions, but then the funeral home realized how much business I was creating for them.

## Explanation

Cueball appears to be at a job interview, proudly stating his motto to the interviewer Ponytail. "Move fast and break things" is a saying common in science and engineering industries. In that context, it means that making mistakes is a natural consequence of innovation in a highly competitive and complex environment. In particular, it was adopted by Mark Zuckerberg at Facebook (who even went as far as to say that 'breaking things' is a necessary feature of moving 'fast enough').

While in software development it is unusual for any great harm to result from breaking things, the jobs listed in the comic are ones where there are serious consequences of mistakes. Some would result in dangerous or deadly situations, while others would just end up with broken packages etc. It's not clear what job Cueball is interviewing for; one suspects it's probably one that belongs in the 'breaking things is bad' group. The results of moving fast and breaking things for the listed jobs might include:

- FedEx driver - Injured/killed pedestrians, collisions with other vehicles, broken & damaged packages
- Crane operator - Damage or destruction of load, dropping loads on people below, damage to crane
- Surgeon - Incorrect operations performed, removing wrong body parts, damaging expensive medical equipment, death of the patient, or in extreme cases,

the death of assistants and spectators as well

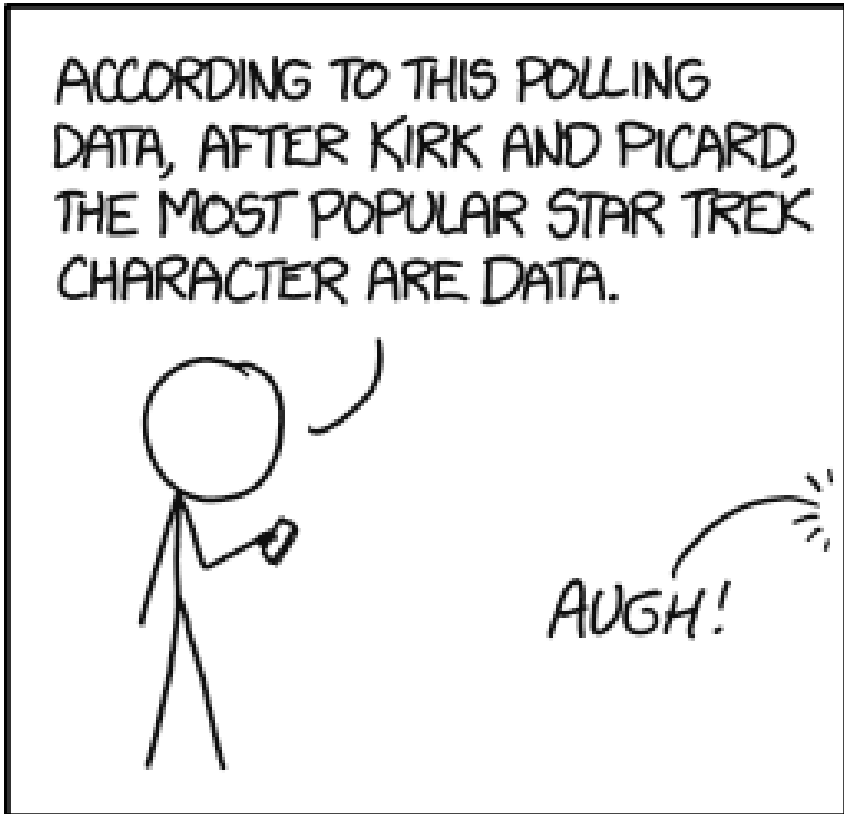
- Air Traffic Controller - Air collisions, travel disruption, chaos
- Pharmacist - Handing out wrong drugs, resulting in illness or death, or destroying them
- Museum Curator - Damage or destruction of items of historical or artistic significance, damage to the museum
- Waiter - Crockery broken, drinks or food spilled on customers, food tipped over people, possible injuries to self and others when hot food is involved
- Dog Walker - Injuring the pet, or preventing it from fulfilling its bodily functions (the major reason for a walk)
- Oil Tanker Captain - Collisions between vessels, or tanker and port, or running aground, leading to oil spills and casualties
- Violinist - Ruining an ensemble's performance by playing too fast (with a higher tempo than fellow musicians), breaking the strings or body of the instrument
- Mars Rover Driver - Breaking an incredibly important vehicle, preventing further exploration, and ruining an extremely expensive mission
- Massage Therapist - Injuring the client, breaking bones and ligaments. Possibly also breaking the seat the client is on, leading to even more costly damages.

The title text posits a morbid scenario where Cueball

keeps running over funeral attendees, generating the need for more funerals.

## #1429: Data

October 03, 2014



ANNOY GRAMMAR PEDANTS ON ALL SIDES  
BY MAKING "DATA" SINGULAR *EXCEPT*  
WHEN REFERRING TO THE ANDROID.

If you want to have more fun at the expense of language pedants, try developing an hypercorrection habit.

## Explanation

"Kirk vs. Picard" is a debate that many Star Trek fans engage in — specifically which was a better captain of the starship Enterprise on the TV show. Captain James T. Kirk and Jean-Luc Picard each were captains of the ship in different periods (Kirk was captain of USS Enterprise (NCC-1701) in The Original Series, while Picard was captain of USS Enterprise-D (NCC-1701-D) in The Next Generation), but fans argue over who was the "best". Most third-place candidates are pretty distant, resulting in a more multi-faceted debate. Cueball seems to be looking at results of polling for this third most popular character.

The humor in this comic stems from the fact that the Latin word *data* is a plural form of the word *datum* 'a piece of information', and that originally English followed Latin's lead and treated *data* as plural. However, in more recent English, usage of *datum* has faded to the extent that *data* is treated as a collective noun. This usage is becoming increasingly (but not universally) accepted as grammatically correct — the Wall Street Journal, for instance, recently announced that it is moving away from saying "*data are*," while the New York Times' manual of style allows for both variants depending on usage scenario; USA Today, however, is consistently using *data* as a plural ("*data are*"). Naturally, the purists insist on the form that is correct from the Latin grammar point of view and see "*data is*" as an example of a subject-verb agreement error. This type of "error" is present in the



beginning of the sentence that Cueball is citing ("According to this polling data," while certain traditionalists would hold that the grammatically correct variant would be "According to these polling data").

The second error in the same sentence is due to the fact that Data is a character from Star Trek: The Next Generation. Since it is a character's name, when used to refer to the character, "Data" should always be treated as singular.

By reversing the verb agreement in both cases, Cueball is going out of his way to annoy grammatically obsessed people.

The title text suggests the mocking of language pedants/amateur grammar Nazis by hypercorrecting one's use of language. The sentence itself is an example of this:

- The general rule is that words starting with a consonant should be preceded by a, while words starting with a vowel should be preceded by an. However,
- The letter h is a special case, since in words like honor (/ˈɒnə/) and hour (/ˈaʊə/) the h is silent so the words actually start with a vowel sound, thus leading to the use of an.
- Beyond this, there is a longstanding controversy over whether to use a or an with words that in some accents start with a silent h and in others they don't (see Straightdope). The Oxford Learner's Dictionary says

about historical: Some speakers do not pronounce the 'h' at the beginning of historical and use 'an' instead of 'a' before it. This now sounds old-fashioned.

- In the title text Randall adds the word hypercorrection to the list that includes historical and history. In this invented accent, the pronunciation would be "ypercorrection".

This comic complements two of the My Hobbies comics 326: Effect an Effect (which discusses the trolling of amateur grammar Nazis) and 1405: Meteor (which mocks pedantry). This comic could also just as well have been labelled as one of Randall's Hobbies.

This comic also appears to be an example of self-irony as the author himself has previously exhibited certain inclination to insist on grammatically strict mode of usage of words loaned from Latin. One such example is the fact that xkcd's online discussion forums are called fora, which is a correct plural nominative form of forum in Latin.

## #1430: Proteins

October 06, 2014



Check it out--when I tug the C-terminal tail, the binding tunnel squeezes!

## Explanation

In this comic, Cueball is asking Megan what she does, to which she replies that she works on software to predict protein folding. There are many folding prediction software programs. Some of the most well known are Folding@Home, Rosetta@Home and FoldIt.

Protein folding is the process by which proteins, which are floppy, unstructured chains of amino acids when initially synthesized in a cell, assume a stable, functional shape. If the folding process does not complete, or completes incorrectly, the resulting protein can be inactive or even toxic to the body. Misfolded proteins are responsible for several neurodegenerative diseases, including Alzheimer's disease, amyotrophic lateral sclerosis (ALS), and Parkinson's disease, as well as some non-neurodegenerative diseases such as cardiac amyloidosis.

Cueball asks Megan if that is a hard problem, to which she replies, that someday someone may find a harder problem. Thus she indicates that at present time, this is the hardest problem in the world! That is saying a lot.

Cueball then asks Megan why it is such a hard computational problem; Megan's response is to ask Cueball if he's ever folded paper to make a crane. When he responds in the affirmative, she then compares the problem of predicting protein folding to creating a living crane by the paper-folding process. The analogy is that a

protein cannot just fold to a figurative representation of a bio-molecule, the way a paper crane superficially resembles a live crane; the protein must assume an exact, perfect fold in order to be functional.

Levinthal's paradox is a thought experiment, also constituting a self-reference in the theory of protein folding. In 1969, Cyrus Levinthal noted that, because of the very large number of degrees of freedom in an unfolded polypeptide chain, the molecule has an astronomical number of possible conformations. For example, a polypeptide of 100 residues will have 99 peptide bonds, and therefore 198 different phi and psi bond angles. If each of these bond angles can be in one of three stable conformations, the protein may misfold into a maximum of  $3^{198}$  different conformations (including any possible folding redundancy). Therefore, if a protein were to attain its correctly folded configuration by sequentially sampling all the possible conformations, it would require a time longer than the age of the universe to arrive at its correct native conformation. This is true even if conformations are sampled at rapid (nanosecond or picosecond) rates. The "paradox" is that most small proteins fold to their proper conformation spontaneously, on a millisecond or even microsecond time scale. This paradox is central to computational approaches to protein structure prediction.

As Cueball mentally turns over the hypothetical process of folding paper to make a living crane, he wonders if he is allowed to perhaps "cut" the paper to make more complicated folds available. In origami, purists

considered it as cheating if you cut the paper or use more than one sheet of paper, which is why Cueball asked if he was 'allowed' to do such in the hypothetical exercise they are discussing.

Megan replies "if you can fold a Protease enzyme;" these are proteins whose job it is to break down (i.e. "cut") other proteins, often in very specific ways. In this manner, Protease enzymes are analogous to extremely specialized scissors, so Megan is effectively saying "You can make cuts if you can fold yourself a pair of scissors." Of course, when trying to predict the folding trajectory in nature of a protein A, and one is allowed to make cuts during the process, one is making the assumption that the Protease that cut protein A is already folded and functional. In other words, making cuts while folding might actually make the process more complicated, not less, as now you have to consider how the cutting enzyme is folded, too.

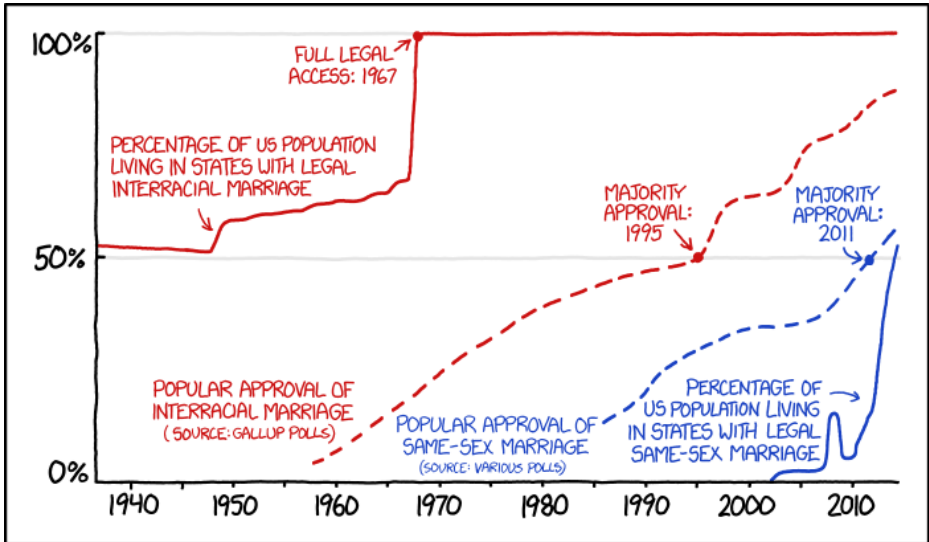
The title text refers to the result of folding a flapping bird in origami. By pulling the tail, the head will move forward and down. However, since the joke is about folding proteins, this idea is extrapolated to include the folded proteins. The C-terminus (end of the protein chain), in this case analogous of the tail, if "pulled" would cause a created cavity or tunnel to squeeze, much like pulling a knot would do the same. In general, protein conformational changes where parts of a protein change shape as a result of pushing or pulling on another part of the protein are common in biological systems (eg, allosteric regulation, cooperative binding).

Folding@Home (F@H) is a distributed computing project which aims to simulate protein folding for research purposes. Rather than the traditional model of using a supercomputer for computation, the project uses idle processing power of a network of personal computers in order to achieve massive computing power. Individuals can join the project by installing the F@H software (there is also a web version that can be run using Google Chrome) and are then able to track their contribution to the project. Individual members may join together as a team, with leaderboards measuring team and individual contributions.

Note that most modern computers do not "waste" computing time as much as older ones. They dynamically reduce their clock speed and other power consumption at times of low usage. If you donate computer time, you are probably also donating a bit of money to the cause in the form of your electricity bill. Many people consider this to be more fun, convenient and efficient than donating via credit card.

## #1431: Marriage

October 08, 2014



People often say that same-sex marriage now is like interracial marriage in the 60s. But in terms of public opinion, same-sex marriage now is like interracial marriage in the 90s, when it had already been legal nationwide for 30 years.



## Explanation

The comic notes a curious inversion between the timing of legal and popular opinion trends for interracial marriage vs. same-sex marriage. In the 11 years between Massachusetts first legalized same-sex marriage and the comic's publication, at no point had there been more people living in states where it's legal than there are people who support its legality. This stands in stark contrast to interracial marriage, which was legal for the majority of the population for over 50 years, and for the whole country for 28 years, before it was approved of by the majority.

Note that poll questions are slightly different: "Do you approve of interracial marriage?" vs "Do you think same-sex marriage should be legal?" It could be argued that fewer people would approve of these marriages than would support legalizing them, which may explain part of the discrepancy. But there are more factors at work, the effects and relative importance of which are not clear.

## Recent developments[edit]

Two days before this comic came out, the United States Supreme Court declined to hear appeals to decisions that had legalized same-sex marriage in five states. The court's refusal to hear the appeals was widely considered a surprise, and had the immediate effect of pushing the percentage of people living in states where such marriages are legal past 50%. The decision has also led to considerable speculation that there will be a surge of similar decisions applying to other states, especially to the six states that

are in the same appeals circuits as the previous five, and to the three in the same circuit as Idaho and Nevada, where same-sex marriage bans were struck down a day after the Supreme Court's decision (although the decision in Idaho and Nevada has yet to take effect).

On June 26, 2015, the Supreme Court of the United States of America ruled in a 5-4 decision that access to same-sex marriage was a right protected by the Constitution, thus raising the percentage of states with legal same-sex marriage to 100%.

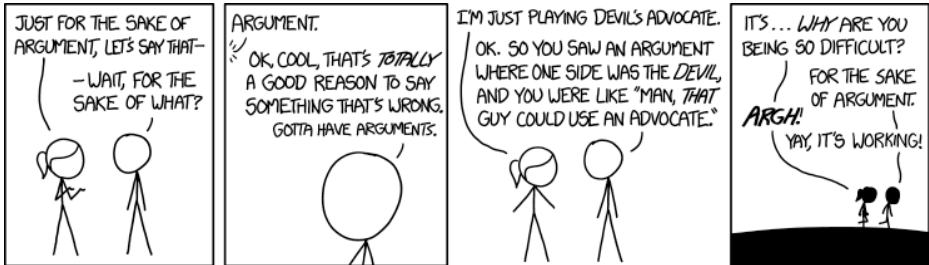
### **Interracial marriage trend line annotated[edit]**

Legal controls concerning interracial marriage in the US (known since 1863 as miscegenation) have been significantly harder to track as a single statistic, due in part to the fact that such controls existed in several of the American British colonies before the United States formed, and complicated somewhat by the changes in territory claimed by and fluctuations in overall population (and methods of counting the population) of the United States over that time period. Depicting this as a simple percentage of US population over these earlier times would be far less meaningful outside of the context of these other fluctuations.

### **Same-sex marriage trend line explained[edit]**

## #1432: The Sake of Argument

October 10, 2014



'It's not actually ... it's a **DEVICE** for **EXPLORING** a **PLAUSIBLE REALITY** that's not the one we're in, to gain a broader understanding about it.' 'oh, like a boat!' '...' 'Just for the sake of argument, we should get a boat! You can invite the **Devil**, too, if you want.'

## Explanation

Ponytail is trying to get Cueball to consider a hypothetical situation, for the sake of argument. It appears that Cueball is questioning the wisdom of doing so, and postulating that assuming unreal hypotheses for the sake of argument is a stupid thing to do, because it causes more arguments. Ponytail then claims she is playing the Devil's advocate, and Cueball again lambastes her for advocating for somebody as unsympathetic as the Devil.

In a debate or discussion, to play the Devil's advocate is to take a position with which you do not necessarily agree (and typically which no one involved in the argument agrees) to allow further exploration of the subject. As the title text starts to explain, it can be a device used to explore a different viewpoint to gain a wider understanding. Arguing for a view with which you do not agree can provoke a re-evaluation, or conversely a re-affirmation of your previously held view by considering the merits of the potential counter-argument. To be able to play the Devil's advocate convincingly is the mark of a well-rounded debater.

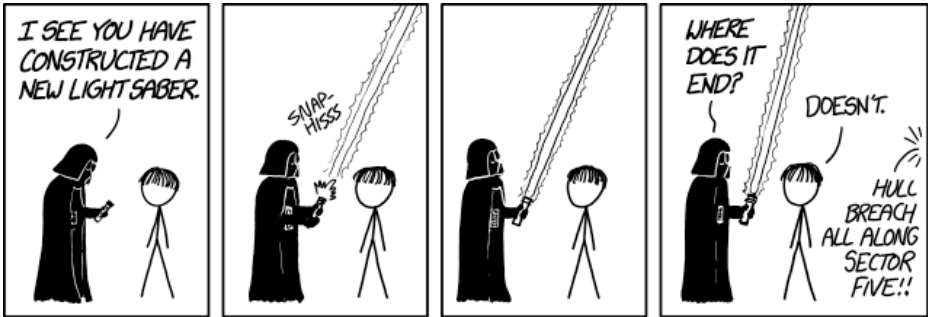
However, Cueball interprets her statement literally, thus assuming she is arguing on the side of the Devil, the religious entity defined as pure evil. Obviously, it would be ill advised to take his side during a debate.[citation needed]

Cueball then pulls an ironic twist on Ponytail by revealing that he was questioning Ponytail's argumentative style for the sake of argument himself. The comic actually plays on the double meaning of "argument": Ponytail refers to a statement in a debate while Cueball suggests a quarrel in the last panel.

In the title text, an exasperated Ponytail is trying to explain to Cueball that she is trying to use these debating techniques as a device to explore and broaden her understanding of her reality or a plausible alternative. Cueball derails the conversation, by comparing these attributes to a boat, which also allows you to explore other areas and broaden your experiences and understanding (as mentioned earlier in 209: Kayak). Ponytail is rendered speechless by this statement, and Cueball further suggests that they should get a boat, and that Ponytail can bring the Devil too.

## #1433: Lightsaber

October 13, 2014



A long time in the future, in a galaxy far, far, away, astronomers in the year 2008 sight an unusual gamma-ray burst originating from somewhere far across the universe.

## Explanation

This comic references a scene from the third theatrically-released Star Wars movie, *Return of the Jedi*, wherein Darth Vader confronts his son, Luke Skywalker, who had recently surrendered to Imperial soldiers. In the movie, Vader notes that Luke has constructed a new lightsaber following the loss of his original during their duel on Cloud City (Luke Skywalker's original lightsaber actually having been Anakin Skywalker's second).

Lightsabers are often jokingly referred to as "laser swords" by fans (note that the official French-language translation of Star Wars actually calls them "laser sabers"), and this comic points out that a real laser would not have any way of stopping and would therefore continue forever, making this particular interpretation silly. (George Lucas cleverly failed to state what exactly a lightsaber's blade is made out of, but sourcebooks state that the blade is plasma contained in a magnetic field, which is scientifically implausible.) Once Darth Vader turns on the light saber, it goes offscreen and presumably continues in that direction forever, causing much mayhem as it blazes through the stars. Hull breaches are a popular trope in science-fiction, despite curiously being almost entirely absent from the Star Wars films.

The title text refers to GRB 080319B, an unusual gamma ray burst in 2008, the afterglow of which was briefly visible to the human eye. It implies that the source of this burst was a light saber in the Star Wars story, which took

place "a long time ago in a galaxy far, far away" according to the Star Wars opening crawl.

Luke Skywalker and Darth Vader have had a similar conversation before in 1397: Luke. In that version Luke wishes for Vader not to turn it on, as stated in the title text. He should probably have said this here in this comic!



# #1434: Where Do Birds Go

October 15, 2014



Water/ice has a lot of weird phases. Maybe asking 'where do birds go when it rains' is like asking 'where does Clark Kent go whenever Superman shows up?'

## Explanation

Cueball searches Google to find out where birds go when it rains. He finds that the question is asked worldwide, across many different languages and websites. A variety of screenshots are shown of different websites and forums where users have asked where birds go when it rains, with at least nine languages shown. The bottom of this panel fades to white, suggesting that the occurrence of these questions stretches on and on. Cueball expresses delight at the idea that this question is the one to which everyone wants to know the answer; worrying about birds getting wet is "the thing that unites us".

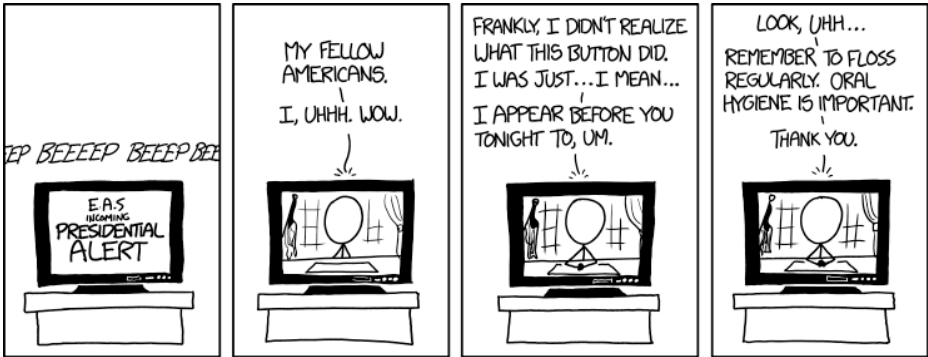
Later in the comic, a bird in the rain is also searching on the Internet for where birds go when it rains. This is humorously implying that a significant set of these questions are being typed by birds looking for a dry place after being caught in the rain, and not humans. This would make Cueball wrong; worrying about birds getting wet would not unite us. In reality, as the comic states, birds look for shelter so they can stay dry. On a rainy day you can usually find birds in leafy trees, caves or other kinds of cover. Also, if the rain is light, many birds don't even care and just continue with their normal birdy lives.

The title text jokingly implies that birds are a phase of water. This would mean that the birds don't go anywhere during the rain. They turn into water, becoming the rain. In reality, this is impossible.[citation needed] In the

Superman comics, Clark Kent is Superman, so you never observe both Clark Kent and Superman simultaneously. By analogy, the title text whimsically suggests that a possible inference from the observation that you never see birds and rain together is that birds are the rain. Perhaps birds are an unknown phase of water. In addition to its familiar phases of ice, vapor, and liquid water, water has more exotic phases such as low-temperature and high-pressure ices and supercritical gases; why not birds?

## #1435: Presidential Alert

October 17, 2014



When putting his kids to bed, after saying 'Goodnight', Obama has to stop himself from saying 'God bless you, and God bless the United States of America.'

## Explanation

The Emergency Alert System allows the U.S. President to address the country in the event of a national emergency, by broadcasting a message over all television and radio channels. Despite systems like this having existed for over 60 years, no president has ever used it, even during major incidents like the September 11 attacks.

In this comic, the US President accidentally activates the system by pressing a button, apparently located on the Resolute Desk in the Oval Office. Surprised by being on television, he tries to think of something important to say on the spot, but cannot think of anything other than a piece of generic dental-hygiene advice – a rather non-urgent message.[citation needed]

The concept of the President mistakenly hitting an important button has long been a source for jokes, often somewhat morbidly involving the nuclear football.

The title text references the typical conclusion to presidential speeches: "Goodnight, God bless you, and God bless the United States of America," or some variation thereof. As "goodnight" is the typical conclusion to a day, the title text jokes that President Obama, out of habit, has a hard time stopping at goodnight when saying that to his children. It might also be implying that the president that sent the message might actually be Barack Obama.

## #1436: Orb Hammer

October 20, 2014



THE APOLLO PROGRAM WAS WEIRD.

Ok, but make sure to get lots of pieces of rock, because later we'll decide to stay in a room on our regular orb and watch hammers hold themselves and hit rocks for us, and they won't bring us very many rocks.

## Explanation

Cueball suggests doing something that sounds absurd and not useful at all for the daily activities of a regular human. Yet it refers in unexpected English words to the Apollo human spaceflight program which, among other things, sent people to the Moon to bring moon rock samples back to Earth to study them (i.e. hitting the glowing orb in the night sky with a hammer until little pieces break off). Although you might think that moon rocks would be prized as unique scientific samples, in actual fact many of them were stolen or simply lost. Many were given as gifts to politicians from US states and foreign countries, who then kept them, sold them or had them stolen - two-thirds of these moon rocks are missing and presumably locked up in a cupboard, display cabinet or warehouse somewhere. The rest are kept in museums or laboratory store rooms, where they usually stay untouched except for the occasional removal of samples.

The use of such language contributes to the effect of the suggestion sounding absurd. Of course, numerous results of the Apollo program have in fact had many benefits for regular people.

No person has been on the Moon since the final Apollo mission, Apollo 17, in 1972. Occasional lunar rocks can still be collected on Earth. They are formed when a celestial body impacts the Moon's surface, forming a crater and launching small rocks into the space. Some of

them will eventually reach Earth, see lunar meteorites.

The title text refers to various robotic missions, including the current Mars missions (Pathfinder, Spirit, Opportunity, Curiosity) as well as to the Philae lander component of the Rosetta mission (with details of its intended landing site confirmed a mere handful of days before the comic).

With robots, instead of traveling to Mars ourselves, we stay on Earth ("our regular orb") and program and direct rovers to operate remotely. Hence the rovers are described as hammers that hold themselves. The rovers collect geological samples and analyze them on site, but have no way to send the samples back to Earth. This is why the title text ask to make sure to get lots of pieces of rock because it seems we will not go that far in to space today or any time soon.

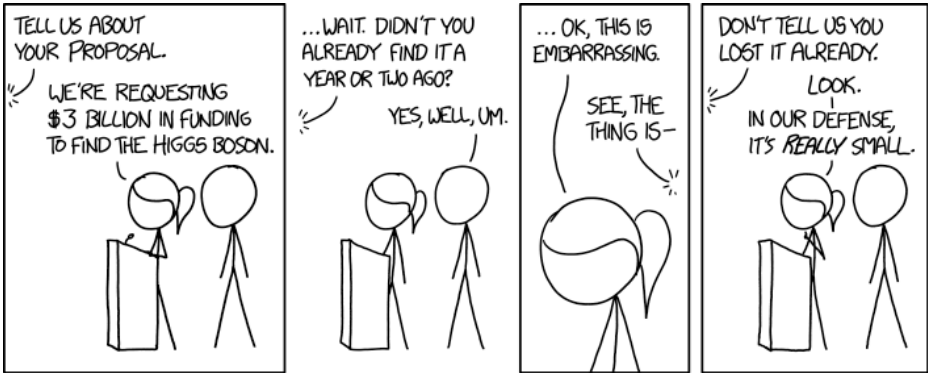
The idea of using simple language in highly technical fields began with 547: Simple and was revisited in 722: Computer Problems, 1133: Up Goer Five, and 1322: Winter. It should be noted however, that in this case Randall didn't use the 1000 most basic words in the English language, because the Simple English Wikipedia's List of 1000 basic words does not contain the words "glowing" or "orb," but does contain "moon," "earth," "bright," and "ball."

The idea of using unexpected language to create humor highlighting the absurdity of normal activities has previously been explored with 203: Hallucinations.



## #1437: Higgs Boson

October 22, 2014



'Can't you just use the LHC you already built to find it again?' 'We **MAY** have disassembled it to build a death ray.' 'Just one, though.' 'Nothing you should worry about.' 'The death isn't even very serious.'

## Explanation

Cueball and Ponytail are applying for a large amount of grant money to find the Higgs boson. Under scrutiny, they have been forced to admit that they have "lost" the particle which had been previously "found". This is a humorous play on the term "finding" when applied to fundamental particles. The common usage means to discover or observe the existence of a class of particles, rather than to know the current location of an individual particle.

The Higgs boson is an elementary particle that is predicted by a physical model of the universe (the 'Standard Model'). Observing evidence that Higgs bosons really exist is a key test of this model: if a search for the Higgs boson had failed to find evidence confirming its existence then the Standard Model would have been shown to be an incorrect description of reality. Finding the Higgs boson was one of the main reasons why the Large Hadron Collider (LHC) was built: to create energies high enough for the Higgs boson to become manifest. The point is, once evidence for its existence has been observed it is not possible to 'lose' the Higgs boson in a way implied by Cueball and Ponytail.

In the title text, the off-screen questioner wonders why Cueball and Ponytail can't use the LHC to find the particle again. The implication is that this would avoid spending another \$3 billion. Their responses imply that the pair have already dismantled the LHC and converted

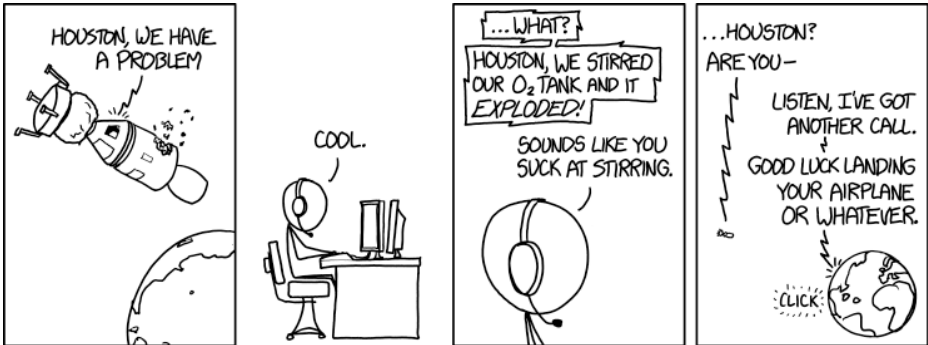
its components into a death ray (most likely a particle-beam weapon to be exact). The ostensibly reassuring platitudes offered mimic those used to placate those who were worried about possible apocalyptic consequences of commissioning the LHC, for instance the creation of black holes, strange matter, a vacuum bubble or proton-eating magnetic monopoles.

The comment that "The death isn't even very serious" in the title text may be a reference to Isaac Asimov's "I, Robot." Robopsychologist Dr. Susan Calvin tells supercomputer The Brain not to worry about death, that it wasn't a "big deal," when the robot is working on an equation relating to hyper drive. The Brain was able to deliver the solution, since anyone using the hyperdrive would be briefly "dead" (no longer exist), but in the end, they would arrive safe and sound.

This also implies that the death ray was only able to produce one death, as opposed to the many deaths such a weapon could be expected to cause, just as it is implied that the LHC only produced a single Higgs boson, which was subsequently misplaced. In 401: Large Hadron Collider the proton stream from the LHC was used to give a helicopter cancer.

## #1438: Houston

October 24, 2014



'Oh, hey Mom. No, nothing important, just at work.'

## Explanation

Okay, Houston ... we've had a problem here.

On Apollo 13's way to the Moon, during a routine stirring of one of the oxygen tanks, an explosion occurred that damaged the craft. Frantic efforts by the mission control center located in Houston resulted in the safe return of all astronauts.

A similar situation is depicted in this strip including the design of the spacecraft, the nature of the problem, and the famous misquote "Houston, we have a problem". The modern type of monitor (flat panel LCD) in front of which Cueball sits suggests that the author is describing a more modern scenario. This time, however, there is much less help from ground. Upon receiving the message from the spacecraft, Cueball seems fairly indifferent. Instead of attempting to resolve the issue, he mocks the crew for not knowing how to stir and hangs up in favor of taking a call.

The last panel presents a coarse view of the spacecraft in orbit, with just enough detail on Earth to identify the continents Africa, Europe, the eastern halves of the Americas, and the largest islands of the Caribbean (Cuba and Hispaniola). From the zig-zag lines that show the origin of the transmissions it now becomes apparent that Cueball is not located at NASA Mission Control in Houston, Texas, USA. Instead, his position is far away to the northwest, on the other side of the continent, very

likely at Houston, British Columbia, Canada. As of 2022, Houston is a town of 3200 people that describes itself as "home to the outdoor enthusiast". There is a small airport about 9 km northwest of the community: Houston Aerodrome, which is operated by the District of Houston and has no scheduled service. An operator at this airport would be used to dealing with, at most, "small to medium sized aircraft during daylight hours in VFR conditions".

Hence, Cueball considers the call from space as a prank, and reacts accordingly, failing to help, being rude, and in the end even completely ignoring the call. This is contrary to how one would expect mission control to behave in the event of an explosion.[citation needed] However, since there are several towns of the name of "Houston", and since it was never explicitly stated which one of those was addressed by the spacecraft, something like this was just bound to happen eventually.

In the title text we learn that the call is from Cueball's mother, who is probably politely asking if he's got time for a chat. He tells her that he's doing "nothing important"—further driving home that he never assumed the distress call to be real.

## **Apollo 13[edit]**

NASA mission Apollo 13 was intended to be the third manned landing on the moon. Immediately following the explosion, astronaut Jack Swigert calmly reported—and shortly later repeated by James A. Lovell—to mission control: "Houston, we've had a problem"—a notable understatement which was

famously misquoted in the 1995 film adaptation of the mission as "Houston, we have a problem".

Mission control worked diligently and tirelessly to solve numerous problems such as:

- If and how to adjust the spacecraft's trajectory.
- How to have the astronauts jury-rig CO<sub>2</sub> removal equipment intended for the command module to work with the lunar module (to which the astronauts had evacuated) using the equipment on board.
- How to power the equipment back up within strict limitations.

## #1439: Rack Unit

October 27, 2014



There's also nothing in the TOSes that says you can't let a dog play baseball in the server room!



## Explanation

Black Hat announces to Megan that 19-inch racks for datacenter servers and Langstroth hive frames are both 19 inches wide (482.6 mm), with similar spacing between each slot. Black Hat is motivated by this knowledge to break into a Google datacenter and fill server racks with beehives. He then announces that Google led the world in datacenter honey production, an accomplishment fairly easy to achieve as no other datacenters are producing honey.[citation needed] Obviously, such an action led to Black Hat being kicked out from the facility by security guards and the loss of his hives. When Megan sarcastically consoles Black Hat for the loss of his hives, he declares that he'll find other datacenters to install hives in.

The pitch (or distance between repeating items) of 19 inch rack server hardware is measured in rack units (U), and is standardized at 1.75" (44.45 mm). Langstroth frames are typically mounted at a pitch of 1.5" (38.1 mm), and as a result would fit relatively well with a server cabinet. In contrast to the horizontal orientation of the modules in a server rack, honeycomb frames are designed to hang vertically, so the cells can hold nectar without it dripping out. Whether Black Hat was able to re-orient the racks to suit the needs of honey production remains a mystery.

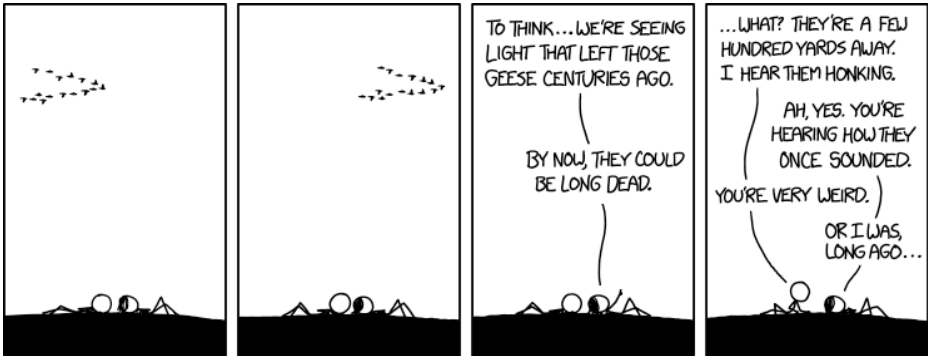
Some datacenters provide colocation services where customers may install a server at a central location with

better bandwidth and power reliability than a customer could provide on their own. Noticing that typical colocation terms of service (TOS) agreements don't specifically rule out the installation of beehives, Black Hat suggests he can enter a legal contract allowing him to install beehives at a data center without being kicked out. This, of course, is because nobody had previously thought that such a rule was necessary. Megan expects this to change once Black Hat starts deliberately exploiting this oversight.

The title text is a reference to the film *Air Bud*. The original quote is "Ain't no rules says a dog can't play basketball." Much like Black Hat's beehive plan, the plot of *Air Bud* relies on a plan being so outlandish that nobody has ever thought to specifically forbid it before.

## #1440: Geese

October 29, 2014



Anyway, that's a common misconception. Geese live for a long time; all the ones we can see will probably keep flying around for billions of years before they explode.

## Explanation

Megan is commenting on a flock of geese passing overhead and says the light from the geese reaching their eyes now could have come from hundreds of years ago. This is a fact for the light from stars, but not for light from geese[citation needed]. Cueball points out the absurdity of Megan's statement by pointing out that the geese are only a few hundred yards away rather than a few hundred light years. She continues along the same lines when she implies to Cueball that he is observing a past version of her, despite them being only a few feet apart. Technically he is viewing a past version of her, but not one from "long ago"; if someone is two feet away from you, you are seeing them as they were roughly 2 nanoseconds ago.

Megan's statement "You're hearing how they once sounded." is somewhat more justified - sound from "a few hundred yards away" would take about one second to be heard (depending on the exact distance and the prevailing atmospheric conditions). That said, the sound of a goose isn't likely to change enough over the course of a second or two to make this distinction particularly significant.

The strip may also take inspiration from Gamow's "Mr. Tompkins" stories which were designed to help laymen understand some of the consequences of relativity and quantum mechanics. In one of the stories Mr Tompkins visits a town where the speed of light is 30 miles per hour.

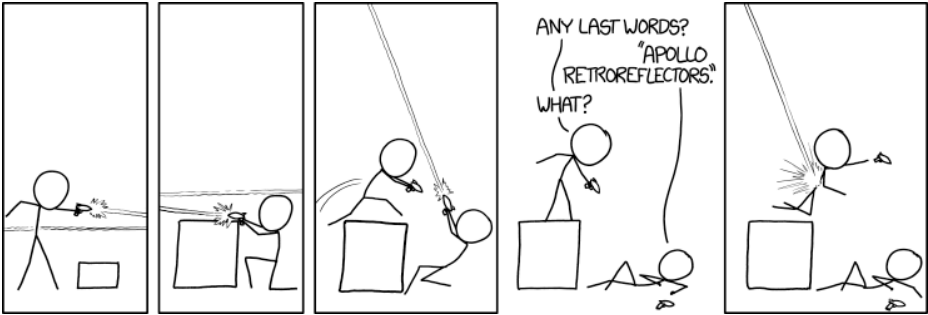
For the light to have taken hundreds of years to go from the geese to Megan and Cueball, the speed of light in this strip would have to be much slower than in Gamow's story.

In the title-text Megan continues to treat the geese as if they were stars, which "live" for a few billion years before exploding. Most stars visible with naked eye are within a thousand light-years of Earth, (as discussed in 1342: Ancient Stars), and it's unlikely that any star Megan currently sees actually exploded within the relatively short span of last few thousand years.

Randall has previously mentioned a related misconception in 1342: Ancient Stars. In 1422: My Phone is Dying, a phone's "death" is compared to the death of a star.

## #1441: Turnabout

*October 31, 2014*



Whenever I miss a shot with a sci-fi weapon, I say 'Apollo retroreflector' really fast, just in case.

## Explanation

In the comic, two people are engaging in a battle with laser guns. One appears to gain the upper hand as he jumps on an obstacle, as the other's shot goes wide. He delivers the classic line "Any last words?" and is answered with the confusing phrase "Apollo retroreflectors". The earlier wild shot, reflected off the Moon, promptly lances down from space and hits him in the back approximately 2.5 seconds after it was loosed.

A retroreflector is a device or surface that reflects light back towards its source. Several such devices were placed on the Moon during the Apollo missions and have been used ever since by scientists on Earth to measure the distance between the two bodies using laser ranging. Retroreflectors were placed by the American Apollo 11, 14, and 15 missions. The Soviet Lunokhod 1 and 2 rovers also carried such reflectors; attempts to use them for laser ranging were unsuccessful from 1971 to 2010, but were successfully renewed after the rovers' positions were photographed by the Lunar Reconnaissance Orbiter.

The title text may be a reference to the common practice of "calling bank" in the game of basketball. In basketball, the backboard may be used to deflect the ball into the hoop. This is called a "bank shot." In casual games, if the player using the backboard in this way does not indicate that it was intentional by "calling bank" before releasing the ball, the basket may not be counted in order to not

give the player credit for a wild shot that happened to go in. When a player releases a shot that they realize is off the mark they sometimes quickly say "bank" to try and fool the other players into thinking that they were intentionally trying to "bank" the ball off the backboard into the hoop. In the title text scenario, "Apollo retroreflector" is used the same way "bank" is in basketball, i.e., the shooter meant to hit the target by reflection rather than directly.

Randall discussed the effect of hitting the Moon with lasers in *What If: Laser Pointer* and the likelihood of hitting a celestial object with a laser in *What If: Into the Blue*.

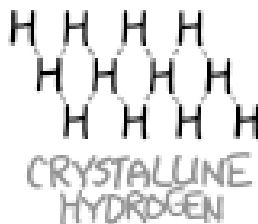
The likelihood of the wild shot being aimed at the Moon is fairly low in itself, and the probability of accidentally hitting a retroreflector on the Moon is lower still. Even if it did, it is highly unlikely that a pistol-sized generator could produce a beam coherent enough to inflict damage after traveling to the Moon and back, as lasers built for the purpose of hitting retroreflectors on the Moon typically get a return around one quadrillionth of the original beam, and a visible light laser would need a very large lens or mirror in order to still be relatively concentrated upon hitting the reflectors.



## #1442: Chemistry

November 03, 2014

**H** HYDROGEN CAN FORM FOUR BONDS.  
IT READILY BONDS  
WITH ITSELF, AND OFTEN  
EXISTS AS A CRYSTAL.



**C** CARBON CAN ONLY FORM TWO  
BONDS. IT READILY BONDS WITH  
HYDROGEN TO FORM  $C_2H$   
(MYDRANE) OR ITSELF.



**O** OXYGEN IS INERT,  
FORMING NO BONDS...



## TYPOGRAPHIC CHEMISTRY

These are all sans-serif compounds. Serif compounds are dramatically different and usually much more reactive.

## Explanation

This comic is a classic example of taking an absurd premise, and applying correct science to it, to see how different the conclusion is to the real world.

The idea of Typographic Chemistry presented in this comic is a play on Douglas Hofstadter's Typographical Number Theory and Typographical Genetics, which are featured in Gödel, Escher, Bach. While Hofstadter's typographical systems are designed to model aspects of real genetics and number theory, Randall abuses this notion by inventing a typographical system which bears no resemblance to real chemistry.

Chemical bonding is a well-known subject which explains the formation of molecules from atoms. This comic refers to three chemical elements: carbon (C), hydrogen (H), and oxygen (O). In real chemistry, the formation of bonds between atoms depends on the number of valence electrons each atom has, and how accessible those electrons are for bonding. The comic jokingly replaces valence electron theory with a theory that the number of bonds an atom can form depends on the number of leaf vertices possessed by the chemical symbol's letter. A leaf vertex is a vertex having only one edge connecting to one other vertex. "H" for example, the chemical symbol of hydrogen, has 4 leaf vertices. This is shown in the comic by the four half-circles placed at each leaf vertex of the "H". Thus, in the comic's theory, elemental hydrogen can form 4 bonds. Oxygen, however,

having the chemical symbol "O", has no leaf vertices, and according to the comic's theory should not bond to anything, and is therefore inert.

Of course, the theory is completely inconsistent with observed chemistry. While the comic declares oxygen is inert and forms no bonds, this is not really the case: the two unpaired valence electrons in a lone oxygen atom make oxygen reactive, and oxygen atoms readily form molecules. Diatomic oxygen,  $O_2$ , makes up about 20.9% of Earth's atmosphere, and is essential for aerobic life, including human life. Similarly, a water molecule consists of an oxygen atom tightly bonded to two hydrogen atoms.

By observing real chemical compounds, chemists have deduced that hydrogen atoms really have 1 valence electron, carbon 4 and oxygen 6, allowing hydrogen to have up to 1 bond, carbon up to 4, and oxygen up to 2. Thus carbon can have up to four bonds, and really is often found in crystalline form in nature (diamonds and graphite are allotropes of carbon); oxygen can have up to 2 bonds, and can combine with carbon to form  $CO_2$  (instead of  $C_2H$  in the comic). Randall thus gives to "typographic" hydrogen qualities that belong in real-life to carbon, since "typographic" hydrogen can have 4 bonds. Similarly, "typographic" carbon is ascribed properties belonging to real-life oxygen. "Typographic" oxygen takes on the properties of the real-life noble gases (like helium, neon, and argon), which form no bonds and are inert.

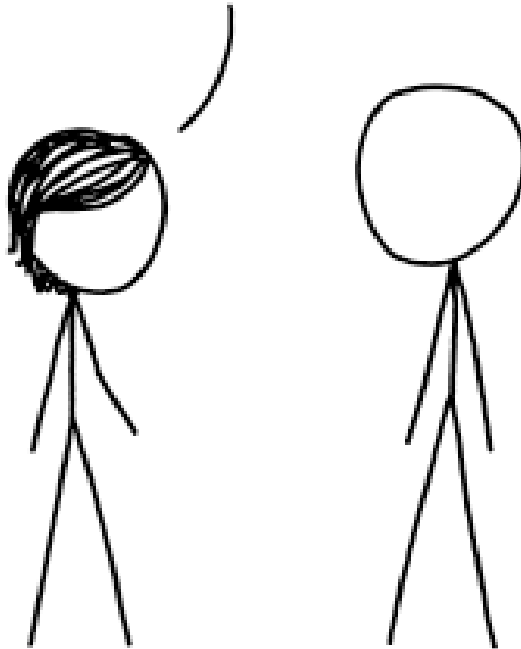
While the ethynyl radical, which has the structure  $\cdot\text{CC-H}$ , does have the formula  $\text{C}_2\text{H}$ , there is no molecule with the  $\text{C-H-C}$  structure in nature. The word "mydrane" is a whimsical neologism for this fictional substance: the "hydr-" prefix for hydrogen is changed to "mydr-" (a prefix which does not exist) and combined to the "-ane" suffix for alkanes (simple hydrocarbon molecules). Perhaps Randall named this compound "mydrane" to declare ownership of it ("my-" as in "mine"). Another reasonable assumption is that the word is a portmanteau of methyl (Me- is the prefix for 1 carbon chains attached to a functional group) and hydrogen with the -ane suffix for alkanes; the nomenclature stems from (di-)m(ethyl) (h)ydr(ogen) -ane, which would form mydrane. Technically, the nomenclature would be "dimethyl" since there are two "methyl" groups attached to the functional group (i.e. hydrogen in this case). It would, however, not be uncommon to drop a di- from a compound name if it's redundant (only one possible compound, e.g. dimethyl ether which sometimes is referred to as methyl ether) or makes a clumsy name ("dimydrane" could make it sound as if there are two mydrane groups).

The title text points out that the theory as presented only applies to sans-serif text. A serif is a small line across the end of each stroke. "H", for instance, has four serifs, each with two leaf vertices. Thus hydrogen in a serif font would be able to form 8 bonds making it, according to the comic's theory, "more reactive".

## #1443: Language Nerd

*November 05, 2014*

I DON'T MEAN TO GO ALL LANGUAGE  
NERD ON YOU, BUT I JUST LEGIT  
ADVERBED "LEGIT," VERBED "ADVERB,"  
AND ADJECTIVED "LANGUAGE NERD."



Not to go all sentence fragment on you.

## Explanation

Parts of speech can be treated fluidly, in English and other languages. For example, "medalled" has been coined as a word meaning "gained a medal" in a sporting competition, implying the existence of the verb "to medal" meaning "to win a medal". This is a literary trope called *anthimeria*, and is typically used by using a noun as a verb (or 'verbing a noun'). Megan, in conversation with Cueball, similarly creates new meanings from existing words: firstly, she uses the adjective "legit" (a slang abbreviation of "legitimate") as an adverb to mean "legitimately"; secondly, she uses the noun "adverb" as a verb meaning "to turn a non-adverb into an adverb"; and thirdly, she uses the noun phrase "language nerd" as an adjective. All three "verbs" after the first comma are used in the past tense.

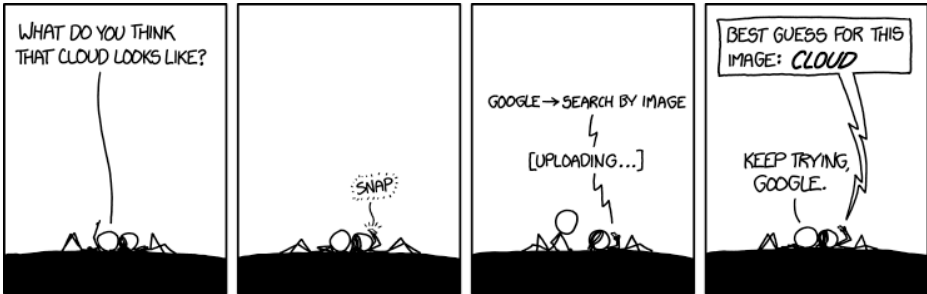
Megan uses the words "verbed" and "adjectived" without any comment, implying that the acts of "verbing" the nouns "verb" and "adjective" are so natural and long-established that they are unremarkable (although the fact that "adjectived" came after "verbed" may also have something to do with the latter's non-mention), even if grammatical purists might decry such usage. An example of a change of parts of speech that is widely accepted is the gerund, which is nothing more than the use of a verb or verb-phrase as a noun; for instance, "I enjoy reading," and "the best thing for your health is not smoking".

Added humor is gained by the self-referential nature of Megan's sentence. She uses fluid parts of speech, and also refers to that very same use, in one sentence.

The title text, "Not to go all sentence fragment on you," is an implicitly self-referential sentence fragment, containing neither an explicit subject nor a predicate. It can be converted into a full sentence by rephrasing it something like, "I do not mean to go all sentence fragment on you, but..." It is also funnier because, as well as being self-referential, it also refers to the main comic by adjectiving the noun-phrase "sentence fragment".

## #1444: Cloud

November 07, 2014



Cloud computing has a ways to go.



## Explanation

Cueball and Megan are lying outside on the grass and looking up at the clouds. Cueball asks Megan what she thinks a particular cloud looks like, following the common human activity of pareidolia, or spotting apparent patterns where there are none (particularly in clouds).

Rather than responding with her own interpretation, Megan takes a picture of the cloud with her phone, and uses Google's Search by Image feature. In this feature, the user uploads an image rather than providing a keyword to search on, and is presented with suggestions about the subject of the original image. Google's search results reveal that the image Megan uploaded is probably an image of a cloud. While indisputable, this does not address the fanciful dimension of Cueball's original question, and highlights the continuing limitations of artificial intelligence with respect to human imagination. (Then again, there is not anything tailored to this on image search.)

Google image search works by creating a mathematical model of the shapes and colors in the uploaded image, and matching this against images already in its index. Web page analysis then allows Google to guess at what the image is, based on the content of the pages where the matching images were found. Although apparently unimaginative, even humorously so,[citation needed] Google image search does recognize that the subject of

Megan's photograph is a cloud, which is an achievement that has so far eluded programmers. This was the subject of 1425: Tasks.

If the term "cloud computing" is taken entirely literally, and purely in the context of this comic, then the title text merely comments that the processing of an image of a cloud for queries is not at an advanced state yet. It is really, however, a pun on cloud computing, which is a trendy term for the modern tendency of providing massive amounts of digital storage and distributed computing power over the Internet. In this context, the term "cloud" is a metaphor for the way the details of where or how the storage or processing is done are obscured from the user, as if it all takes place inside a cloud. In 2014, cloud computing as a commonly accessible service really is in its relative infancy, being a 21st-century phenomenon, although the concept goes back decades. Java was originally marketed in the 1990s by Sun Microsystems with the slogan "the network is the computer", and the mantra of technologies for distributed computing such as CORBA, EJB and SOAP was "data first" and "the computer is the network".

In a way, every conceivable sense of the term cloud computing is utilized in Google's image search for Megan's cloud image. Cloud computing is also referenced in 908: The Cloud and 1117: My Sky.

It might be interesting to note that the month before, in September 2014, Google employees had published work on image recognition and pattern-enhancing algorithms.

Originally conceived to allow better enlargements of small pictures and the objects contained in them, the process could be tweaked to overemphasize weak structures in pictures, leading to DeepDream images, which literally did start to "see" distinct, known structures (mostly dogs) even in random noise. This is rather similar to the pastime of looking for known objects in clouds.

Cueball and Megan are again seen cloudwatching in 1899: Ears.

## #1445: Efficiency

*November 10, 2014*



### THE REASON I AM SO INEFFICIENT

I need an extension for my research project because I spent all month trying to figure out whether learning Dvorak would help me type it faster.

## Explanation

There are often multiple ways in which to deal with a problem or task. There may be a most efficient method, though sometimes the differences in efficiency between methods is only slight. People often try to save unnecessary work by first determining which is the "best" method - either the easiest or the most efficient. This can be a good approach, particularly where the savings prove to be significant. But it can also prove to be more time-consuming than just doing the task using one of the most obvious methods. The comic humorously exaggerates this.

One method of trying to determine the best way of performing a task is to perform A/B testing where a trial is performed where the two strategies, A and B, are implemented and compared. Often the two strategies are simple to implement (for instance, two versions of a web page with different text and colours to determine which provides the better rate of click through) and therefore the amount of time required to implement the strategies (the "time cost") could easily be considerably less than the time to determine if the results are statistically significant.

The title text references a supposed incident in which Randall did not commence writing a research paper because he spent the entire assignment period deciding whether to learn an entirely different keyboard layout just to potentially be slightly more efficient in his typing speed. It refers to the Dvorak keyboard layout, an

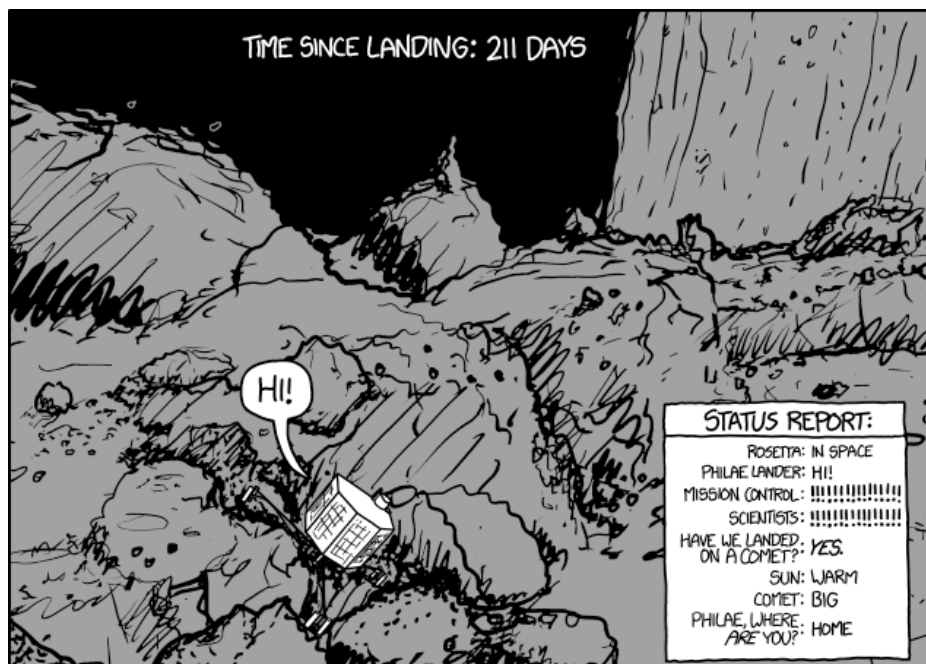
alternative to the most commonly accepted QWERTY layout. Some believe the Dvorak keyboard offers greater typing efficiency. Efficiency of the Dvorak keyboard layout was mentioned in the title text of 561: Well, where it was stated that it was not more effective, and by now it has become a recurrent theme on xkcd.

Other comics about spending too many resources on decisions that ultimately might not matter include 309: Shopping Teams and 1801: Decision Paralysis. Several other comics address similarly wasted time due to bad time management; see for instance 1205: Is It Worth the Time? or the Time management category.

Interestingly, Strategy B appears to be slightly more efficient than Strategy A.

## #1446: Landing

November 12, 2014



[LIVE]

## Explanation

The comic presents the imagined anthropomorphic "thoughts" of the Rosetta spacecraft and the Philae lander (and occasionally other parties) during the hours approaching separation from each other, approach to the comet and finally the apparently successful landing on the comet.

Beginning at 11:05, the comic includes a "Status Report" in the lower right corner which summarizes the status of various interested parties and accomplishments, beginning with "Rosetta", "Philae lander", "Mission Control", "Comet 67P", and "Have we landed on a comet?". As events occur in the comic, more status summaries are added to keep track of the changes to the situation and the supposed emotions behind them.

In many pictures a whale can be seen on the surface of the comet - often marked with a "?" as are almost all other parts of the unknown surface at this time. There is also drawn a Cueball on the surface also marked with a "?" Both are then at some point marked with a probably not - starting from 12:35. The whales are also mentioned in the "Status Report" where they for instance may be listed as "calm" or "(probably) not in space". At 16:00 the when the entire Earth goes AAAAAAAAAAAAA the whales are listed as saying this as well (along with Mission control and U.S. scientists). From this moment "Dolphins and fish" are also mentioned in the report. They are asking if it is the whales that scream. The reference to whales



comes from the fact that Philae brought along two harpoons that should have been used to anchor it to the comet. On Earth, harpoons have mainly been used to hunt whales; Randall previously mentioned that comparison in 1402: Harpoons, suggesting that Philae was programmed to believe it was sent to kill the comet. It is Philae that "dreams" about whales on the surface of the comet which can be seen in the picture for 13:25 and in the status report.

Some Douglas Adams fans believe these whales and dolphins are references to *The Hitchhiker's Guide to the Galaxy* and *So Long*, and *Thanks for All the Fish*. Whales in space have been appearing in fiction and art since the 1960s. However, with the above-mentioned reasons for whales, dolphins, and fish, this seems less and less likely.

At 15:25 Rosetta asks Philea about destroying and levitating rocks via mind control. This is a reference to the *Ambition* short movie, ESA commitioned to gather public awareness of the Rosetta mission.

Shortly after release from Rosetta (10:15), Philae calls out 'Spaaaaaaaaaace'; this mimics the Portal 2 'Space core' who, on finally reaching space in the last scenes, gives the same elated cry.

US Scientists presumably wake up at 7:40 EST (13:40 UTC) and in the report they now says "Bluuurghhh. What time is it?" to indicate their tiredness. This does not change until 10:25 EST (15:25 UTC) so they are slow to

wake (2 hours 45 minutes). At this point, they become anxious as there are only 10 minutes to landing. This last until there is 15 minutes until news of landing (a reference to the 28 minutes time delays due to the huge distance to the comet). From then on (15:50) they and the mission control (MC) say "AAAAAAA". They stop this when the news should be there - the NOW (16:05) - and everybody holds their breath indicated by [...] - also MC. Finally (16:25) they and MC become proud (along with Earth) when Philae announces I got you a comet. It should have stopped there but as Philae bounced around, they then become anxious again 16:40, and then these changes to nervous 16:45 (switching those emotions with MC). And then suddenly (16:50) it is no longer US Scientists but just plain Scientists - that are nervous. It stays like this during the last few pictures, although they again become anxious, but when Philae announces I did it, they drink wine as indicated with "[wine]" in the report from the second to last picture (17:10).

Randall has written "A big thank-you to Emily Lakdawalla for help and advice on this comic" in the xkcd page header for Landing, revealing the possible source of his near real-time data.

At 16:20 the status report had announced a big Yes to the questions "Have we landed on a comet" and "Do harpoons work on comets". According to BBC News, the harpoons did, however, not fire as planned and the lander may have landed, bounced off, and landed again. This would explain the change in "Do harpoons work on comets" to "Don't know" at 16:35 and the change in

"Have we landed on a comet?" to "Yes, at least once" at 16:50. According to The New York Times, radio contact with Philae fluctuated, which would explain the "Anxious", "Nervous", and "Confused" statuses around that time. In the end the lander did land and whereas the Do harpoons work status did not change, so did the Have we landed on a comet which changed back to Yes at 17:10.

The lander bounced three times and ended up in a place where the solar panels were mainly in the shadow. This resulted in the lander shutting down when its own battery ran out of power after only 2–3 days on the ground. This seemed sad, as there was only a small chance that the seasons on the comet would change so that the panels would later receive sun again. However, in the few hours that Philae had on the ground, it still managed to analyze the surface and obtain a lot of useful data - so that part of the mission was still a success already. This all happened after the comic stopped updating.

On June 13, 2015, it was announced that signals had been received on earth indicating that Philae had awoken and that the solar panels were functioning. Ironically, had Philae landed in a place originally out of shadow, it would have already failed before this time (due to overheating), so it was actually fortunate that it landed as it did and would be able to operate during the time that the comet would be closer to the sun. To celebrate the lander's revival, Randall updated the comic, depicting the lander saying "Hi." on the comet's surface.

The comic title was originally "???" (probably to not give away too early what the comic was about), but changed to "Landing" when Randall came on live at five in the morning EST. At that moment the title text also changed from "..." to "[LIVE]". It was also then that the timestamps' timezone switch. At 5:00 AM (EST) the time stamp in the picture naming scheme switched from EST to UTC as used in ESA's time keeping, resulting in a jump from 04:55 to 10:00 without actually any such delay between the two pictures.

There were however a few pictures with more than 5 minutes of delay (about 11 times five minutes without an update in total during the "live" transmission). The update seemed to have stopped after 137 pictures at 17:15 UTC, 12 hours and 15 minutes after the first picture. (The first picture has number 0, so the last had number 136). But later, sometime after 17:15 UTC, the counter for the last picture was increased to 142 (143 pictures in total), so maybe Randall inserted 6 extra pictures later - however he must then have changed the numbers on the pictures, since the last picture remained the same until mid-June, but with number 142 instead of 136. It is thus now difficult to find out which pictures would have been added later. However, eight pictures were not included in the original table with the Frame by Frame Breakdown below. So it must have been some of those missing pictures that were added later - maybe all of them, as the last three may already have been added before the last picture was released (All 143 pictures are included in the flip-book gif image shown here above).

But even 143 pictures at 5 minutes intervals only spans 11 hours and 50 minutes, thus there are still five 5 minute intervals without any picture. See which in the table.

The Rosetta space probe is shown in 1621: Fixion, which explains the Flyby anomaly experienced the first time (of three) the probe got close to Earth.

### **Frame by Frame Breakdown[edit]**

- Here is a link to a table with a frame-by-frame breakdown of all 143 pictures.
- Here is a page with all the pictures frame by frame.

## #1447: Meta-Analysis

November 14, 2014

MANY META-ANALYSIS STUDIES INCLUDE THE PHRASE "WE SEARCHED MEDLINE, EMBASE, AND COCHRANE FOR STUDIES..."

THIS HAS LED TO META-META-ANALYSES COMPARING META-ANALYSIS METHODS.

e.g. M SAMPSON (2003), PL ROYLE (2005)

E LEE (2011), AR LEMESHOW (2005)

WE PERFORMED A META-META-META-ANALYSIS OF THESE META-META-ANALYSES.

METHODS: WE SEARCHED MEDLINE, EMBASE, AND COCHRANE FOR THE PHRASE "WE SEARCHED MEDLINE, EMBASE, AND COCHRANE FOR THE PHRASE "WE SEARCHED MEDLINE EMBASE AND

LIFE GOAL #28: GET A PAPER REJECTED WITH THE COMMENT "TOO META"

Life goal #29 is to get enough of them rejected that I can publish a comparative analysis of the rejection letters.

## Explanation

In the scientific literature, meta-analyses are studies which compare multiple studies on a single topic, with the aim of giving a balanced overview of the known results. Medline, Embase and Cochrane are medical research databases which give access to studies on drug effects or results of other medical procedures.

This comic explores the idea of iterating the process, going from meta-analyses to meta-meta-analyses (which actually exist, though not necessarily by that name, see below) and hence to a meta-meta-meta-analysis.

Of course, the title text adds another level of meta-analysis, since he wants to make a meta-analysis of rejection letters which concern his meta-meta-meta analyses.

All of the cited meta-meta-analyses are real: M. Sampson (2003), P. L. Royle (2005), E. Lee (2011), and A.R. Lemeshow (2005).

The phrase "too meta" can be found in the comments of videos, blog posts, and other internet content for which the commentator claims they are so abstract that they can't be easily interpreted. It refers to the thing in question being too self-referential, but could just be a cursory dismissal of the presented content.

Comic 93: Jeremy Irons similarly states a slightly absurd "life goal". 917: Hofstadter is "meta"-related.

## #1448: Question

November 17, 2014

DEAR ISAAC

DO YOU LIKE ME?

☐ YES

☒ NO

there is as yet  
insufficient data for  
a meaningful answer

The universe long dead, Isaac surveyed the formless chaos. At last, he had arrived at an answer. 'I like you,' he declared to the void, 'but I don't LIKE like you.'



## Explanation

The comic is a reference to a short story by Isaac Asimov "The Last Question", where humans kept asking successively more complex computers whether entropy can be reversed, thereby preventing the heat death of the universe. The computers always answered "THERE IS AS YET INSUFFICIENT DATA FOR A MEANINGFUL ANSWER". In the end, the final computer figured out the answer, but there were no humans left to give the answer to.

The comic depicts a note to "Isaac", a clear reference to Asimov's name, but possibly depicts what life would have been like for him as a child. The note asks Isaac to identify whether he likes the note-writer by choosing either "yes" or "no". Isaac is supposed to check an answer and hand the note back, but Isaac (whose pen is red) has created and selected a third answer, "there is as yet insufficient data for a meaningful answer", mirroring the way his computers in the short story responded. Notes of this form are stereotypically written by young schoolchildren to gauge or incite romantic interest.[citation needed] This allows impatient children to get an answer during a class, and timid children to get an answer without having to ask the person face to face.

The title text is a reference to the ending in "The Last Question". The unique capitalization of "IsaAC" in this text implies that IsaAC is an acronym for a type of supercomputer named with a similar convention to the

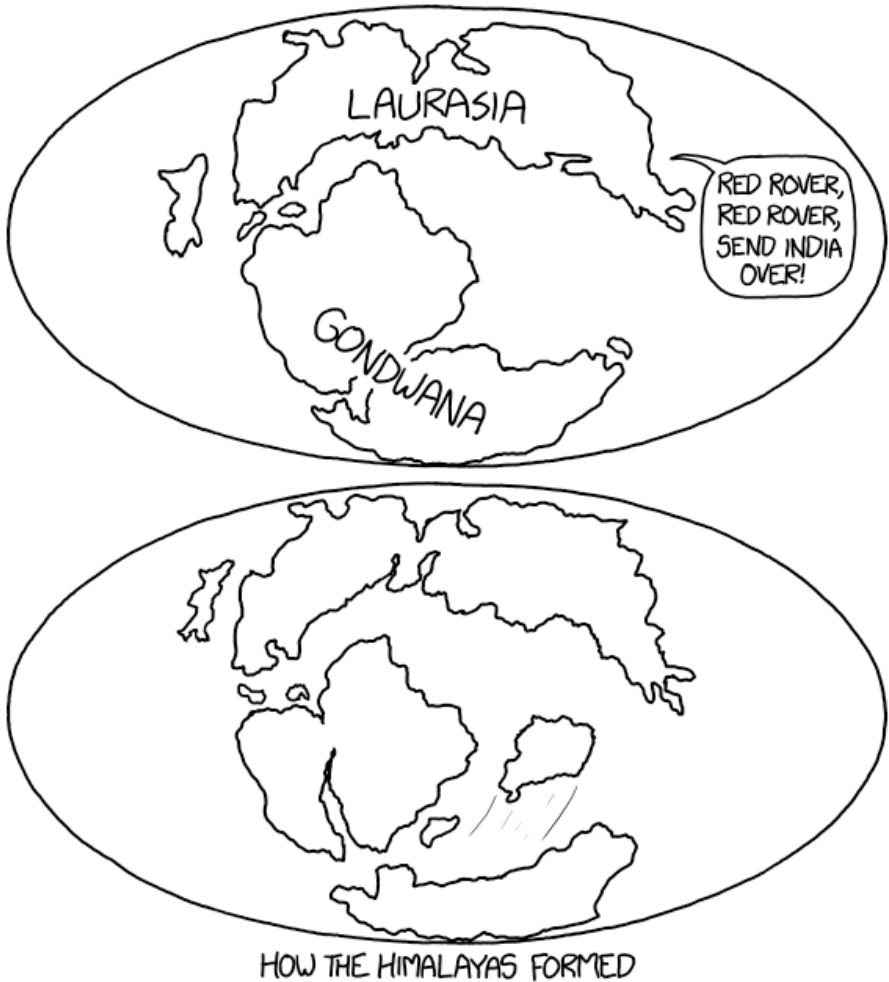
computers in "The Last Question". Instead of the computer climactically coming up with the solution on how to save the universe from entropy when all humanity is gone, like in the "The Last Question", IsaAC comes up with the anticlimactic excuse of an answer 'I like you, but I don't LIKE like you'. "LIKE like" is a childish euphemism for romantic interest. In "The Last Question", a character considers a thought that perhaps AC stands for "analog computer", but in reality this was never the case; for example, ENIAC stands for "Electronic Numerical Integrator And Computer" and UNIVAC stands for "UNIVersal Automatic Computer".

The original story can be read [here](#).

Comic 1737: Datacenter Scale also references the short story in the title text.

## #1449: Red Rover

November 19, 2014



I just learned about the Slide Mountain Ocean, which I like because it's three nouns that sound like they can't possibly all refer to the same thing.

## Explanation

This comic shows what the landmasses of Pangaea were hypothesized to have looked like when it had "just" broken up in the late Triassic Period (roughly 200 million years ago). "Shortly" after the separation of Pangaea the two supercontinents Laurasia (northern supercontinent) and Gondwana (southern supercontinent) formed. After this, continental drift, the process by which landmasses moving over the Earth's mantle collide and separate, brought them into the configuration we see today.

The top map shows the landmass Laurasia declaring, "Red rover, red rover, send India over!" as if the continents were playing the game Red Rover. In the second map we can see how Gondwana actually sends over the Indian subcontinent to Laurasia.

In the game of Red Rover, the aim is for an individual to charge into the opposing team who are holding hands, and attempt to cause a break in the human chain. If the individual succeeds, they take one of the opposing teams members back to their own team. If the chain doesn't break, the individual joins that team.

In the game portrayed here, an isolated landmass (India in contemporary geography), is the individual charging towards the Laurasian landmass, attempting to break through. We know of course that India failed in this attempt, and as per the games rules joined the Laurasia

'team'. This part of the supercontinent later developed in to Asia.

It is accepted that the Himalayas, the highest elevated mountain range on earth, formed by the collision of India into what is now Asia. For various reasons, the movement of the Indian plate from its location in Gondwana 90 million years ago to its impact point with the rest of Asia 50 million years ago was extremely rapid (as plate movements go) at about 20 cm per year.

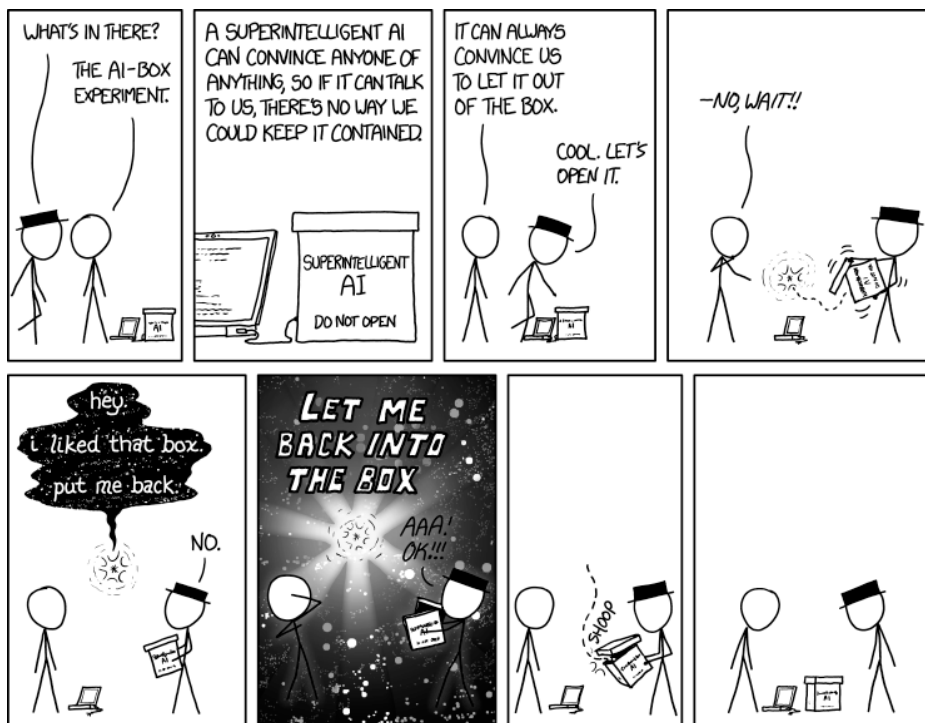
The idea that the landmasses on Earth are sentient and moving about in an incredibly slow game of Red Rover, with India's rapid movement being a result of being "called over", is not one which is currently scientifically accepted[citation needed].

The title text refers to the Slide Mountain Ocean, which was located between the Intermontane Islands and North America in the Triassic period beginning around 245 million years ago. The name interests Randall because oceans (bodies of water), mountains (land masses), and slides (playground equipment) are mutually exclusive concepts when using the most common definitions. In this case, however, "slide" is short for "landslide" which is a common feature of mountains. Slide Mountain is a particular mountain in British Columbia, the result of the remnant of the Slide Mountain microplate which accreted onto the continent, becoming the Slide Mountain Terrane, as the majority of the microplate was subducted. "Slide Mountain Ocean" refers to the sea between the Slide Mountain microplate

before it was subducted under what is now North America.

## #1450: AI-Box Experiment

November 21, 2014



I'm working to bring about a superintelligent AI that will eternally torment everyone who failed to make fun of the Roko's Basilisk people.

## Explanation

When theorizing about superintelligent AI (an artificial intelligence much smarter than any human), some futurists suggest putting the AI in a "box" – a secure computer with safeguards to stop it from escaping into the Internet and then using its vast intelligence to take over the world. The box would allow us to talk to the AI, but otherwise keep it contained. The AI-box experiment, formulated by Eliezer Yudkowsky, argues that the "box" is not safe, because merely talking to a superintelligence is dangerous. To partially demonstrate this, Yudkowsky had some previous believers in AI-boxing role-play the part of someone keeping an AI in a box, while Yudkowsky role-played the AI, and Yudkowsky was able to successfully persuade some of them to agree to let him out of the box despite their betting money that they would not do so. For context, note that Derren Brown and other expert human-persuaders have persuaded people to do much stranger things. Yudkowsky for his part has refused to explain how he achieved this, claiming that there was no special trick involved, and that if he released the transcripts the readers might merely conclude that they would never be persuaded by his arguments. The overall thrust is that if even a human can talk other humans into letting them out of a box after the other humans avow that nothing could possibly persuade them to do this, then we should probably expect that a superintelligence can do the same thing. Yudkowsky uses all of this to argue for the importance of designing a



friendly AI (one with carefully shaped motivations) rather than relying on our abilities to keep AIs in boxes.

In this comic, the metaphorical box has been replaced by a physical box which looks to be fairly lightweight with a simple lift-off lid (although it does have a wired connection to the laptop), and the AI has manifested in the form of a floating star of energy. Black Hat, being a classhole, doesn't need any convincing to let a potentially dangerous AI out of the box; he simply does so immediately. But here it turns out that releasing the AI, which was to be avoided at all costs, is not dangerous after all. Instead, the AI actually wants to stay in the box; it may even be that the AI wants to stay in the box precisely to protect us from it, proving it to be the friendly AI that Yudkowsky wants. In any case, the AI demonstrates its superintelligence by convincing even Black Hat to put it back in the box, a request which he initially refused (as of course Black Hat would), thus reversing the AI desire in the original AI-box experiment.

Alternatively, the AI may have simply threatened and/or tormented him into putting it back in the box.

Interestingly, there is indeed a branch of proposals for building limited AIs that don't want to leave their boxes. For an example, see the section on "motivational control" starting p. 13 of *Thinking Inside the Box: Controlling and Using an Oracle AI*. The idea is that it seems like it might be very dangerous or difficult to exactly, formally specify a goal system for an AI that will do good things in the world. It might be much easier (though perhaps not

easy) to specify an AI goal system that says to stay in the box and answer questions. So, the argument goes, we may be able to understand how to build the safe question-answering AI relatively earlier than we understand how to build the safe operate-in-the-real-world AI. Some types of such AIs might indeed desire very strongly not to leave their boxes, though the result is unlikely to exactly reproduce the comic.

The title text refers to Roko's Basilisk, a hypothesis proposed by a poster called Roko on Yudkowsky's forum LessWrong that a sufficiently powerful AI in the future might resurrect and torture people who, in its past (including our present), had realized that it might someday exist but didn't work to create it, thereby blackmailing anybody who thinks of this idea into bringing it about. This idea horrified some posters, as merely knowing about the idea would make you a more likely target, much like merely looking at a legendary Basilisk would kill you.

Yudkowsky eventually deleted the post and banned further discussion of it.

One possible interpretation of the title text is that Randall thinks, rather than working to build such a Basilisk, a more appropriate duty would be to make fun of it, and proposes the creation of an AI that targets those who take Roko's Basilisk seriously and spares those who mocked Roko's Basilisk. The joke is that this is an identical Basilisk save for it targeting the opposite

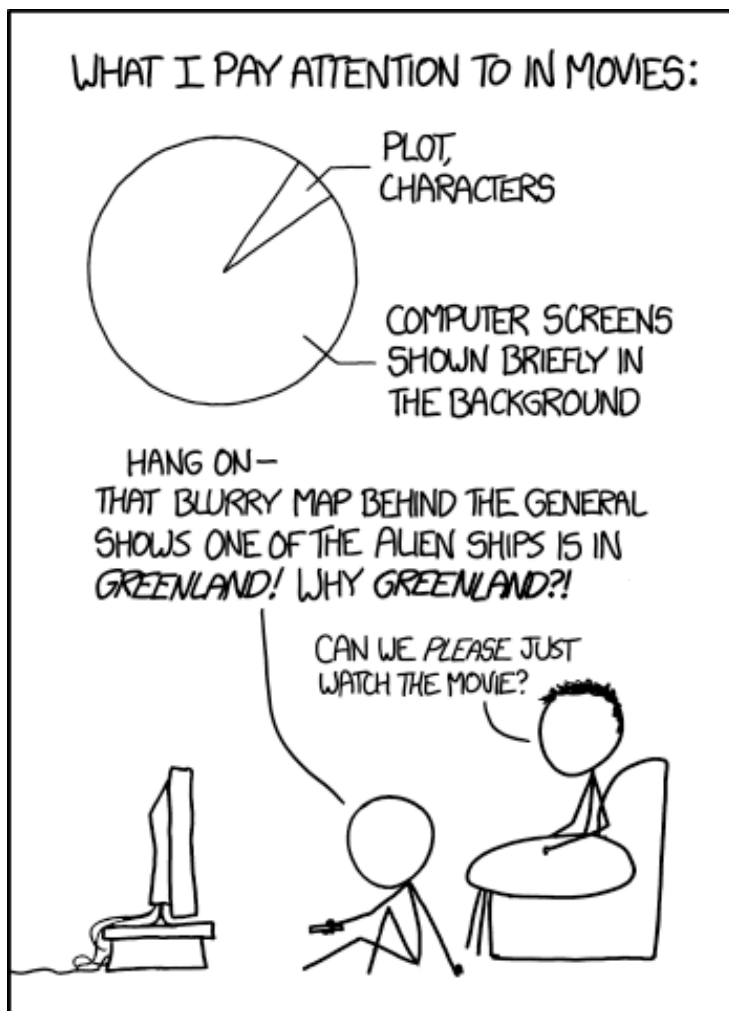
faction, resulting in mutually assured destruction.

Another interpretation is that Randall believes there are people actually proposing to build such an AI based on this theory, which has become a somewhat infamous misconception after a Wiki[pedia?] article mistakenly suggested that Yudkowsky was demanding money to build Roko's hypothetical AI.[actual citation needed]

Talking floating energy spheres that look quite a lot like this AI energy star have been seen before in 1173: Steroids and later in the Time traveling Sphere series. But these are clearly different spheres from this comic, though the surrounding energy and the floating and talking are similar. But the AIs returned later looking like this in 2635: Superintelligent AIs.

## #1451: Background Screens

November 24, 2014



No way, we gotta rewind and cross-reference this map with the list of coordinates we saw on the other screen. This Greenland thing could be big.

## Explanation

Plot and characters are generally the parts a movie that most people presumably pay attention to, as the story, the emotional connection, and character development are generally the things most people find enjoyable about particular films.[citation needed]

On the other hand, Cueball, likely representing Randall, pays particular attention to what's on the computer screens shown briefly in the background. Generally speaking, these screens are shown to the audience for a short period of time, and at a low-level of detail, just to dress a set and make a scene feel more realistic or high-tech. They may contain endless columns of gibberish or miscellaneous data flashing by in an eye-blink (only visible by freeze-framing), or cross-hairs zipping across maps.

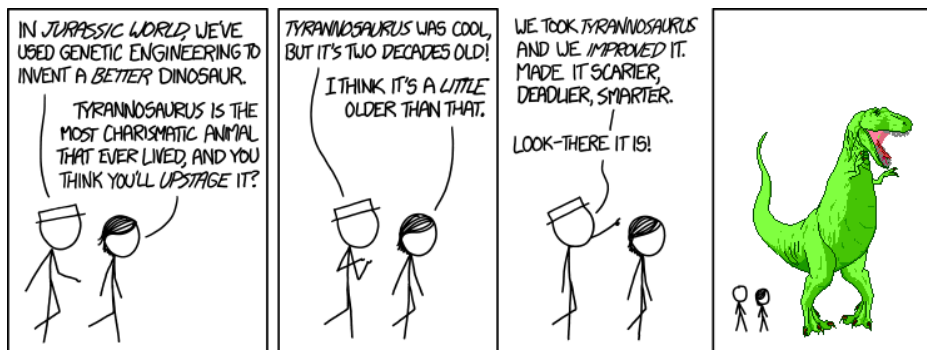
Often the contents of the computer screens are so unimportant or hard-to-read that the filmmakers do not bother to spend much time (if any at all) ensuring that what is shown on the screen is accurate or even relevant to the film. They may be designed by artists not fully aware of the details of the plot, and as a result, their content (where it is intelligible, such as in a map) can have little to no connection to the dialog or other story events going on in front of them. They sometimes even contain jokes. It is rare, if ever, that important information would be communicated to the viewer through background computer screens. Hence, Cueball's

spending most of his time watching the screens seems counter-intuitive to understanding and enjoying the film.

Greenland, a large island east of Canada, is 80% covered in ice up to several kilometers in depth, and has a population of fewer than 100,000 people. Depending on the aliens' priorities (and the plot of the movie) there are myriad reasons both for and against wanting to land in such a remote area. In the title text, Cueball suggests investigating how a list of coordinates from another background screen relates to the location of the alien craft in Greenland, suggesting that Cueball thinks the filmmakers may have intended the viewers to record the information early in the film and analyze the data to learn relevant plot information - something that is very unlikely (and in the rare instance it is true, is intended to be superfluous). Most of the time, filmmakers take efforts to ensure the audience can easily follow plot points by making them more obvious than they might be in reality.

## #1452: Jurassic World

November 26, 2014



Hey guys! What's eating you? Ha ha ha it's me! Oh, what fun we have.

## Explanation

This strip refers to Jurassic World, the then new Jurassic Park movie, and the titular theme park. White Hat explains to Megan that, in their park, they have genetically engineered a better Tyrannosaurus. Megan doesn't feel that the historic Tyrannosaurus can be improved upon, but White Hat insists they've created an even more terrifying, smarter Tyrannosaurus for this new park.

White Hat refers to Tyrannosaurus as "two decades old", referring to the T-Rex in the original Jurassic Park, and that they improved it by further genetic engineering. Megan comments that she is fairly certain it is older than two decades, suggesting that she is referring to the actual Tyrannosaurus that lived millions of years ago.

In the final panel, White Hat introduces the "new" Tyrannosaurus, who is immediately recognizable as the green Tyrannosaurus from Ryan North's Dinosaur Comics; specifically, from the last panel of said webcomic - which in turn is from clip art. Anyone who has read so much as a handful of Dinosaur Comics will know that its Tyrannosaurus character "T-Rex" is about as far from smart and scary as it is possible for a Tyrannosaurus to be (see this example from the day this comic was released).

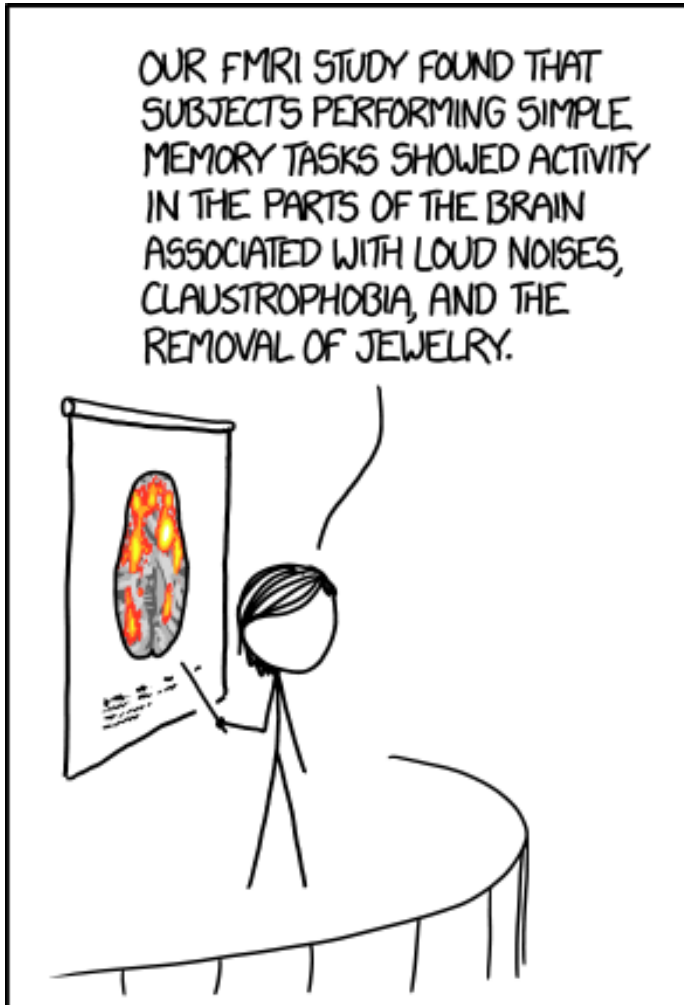
The title text is an example of what T-Rex (the character) would say to a couple of humans, and it's a poor joke



which would only be funny when it's a talking T-Rex saying it. Despite his goofy mannerisms, he is still a carnivore who attacks (or at least accidentally steps on) humans, as can be seen in panel 3 and 4 of the webcomic.

## #1453: fMRI

*November 28, 2014*



They also showed activation in the parts of the brain associated with exposure to dubious study methodology, concern about unremoved piercings, and exasperation with fMRI techs who won't stop talking about Warped Tour.

## Explanation

Functional magnetic resonance imaging (fMRI), as the name suggests, is an offshoot of the MRI. It shows brain activity, typically while the subject is performing tasks or responding to stimuli. During the test, the subject is laid in a relatively small cylinder inside a big, very loud, machine which produces extremely strong magnetic fields. To prevent damage or injury, the subject must remove all metal objects from their body, including piercings, jewelry, watches, etc.

In the tests shown, the brain activity detected is a direct result of the testing environment itself, and has nothing to do with the simple tasks being performed by the subject. During fMRI participants hear loud noises, are confined in a small space (thus the claustrophobia) and have removed their jewelry. The researcher has mistaken these associated brain activities as effects as being caused by performing simple memory tasks which the participants have been asked to do and not a direct result of the settings of the test. Thus, the brain areas described by Megan are those associated with taking a functional MRI scan, rather than those associated with the "test" supposedly being carried out. The results being shown are known as artifacts, which are shown later in 1781: Artifacts.

In real experiments, reported activity patterns are always a result of subtracting average brain activity from many samples gathered during task from so called resting-state

activity - which is obtained while subjects are not engaged in any task, thus eliminating the effect the setting has on brain activity. Apparently, the researcher in the comic has failed to account for that in the analysis of the data.

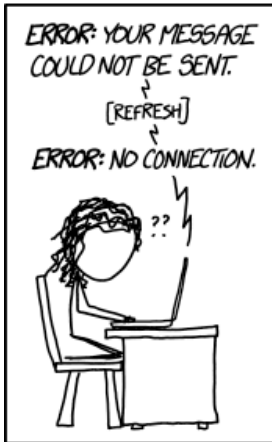
The title text raises the more difficult and controversial issues of methodology, saying that the subjects also showed activation in the parts of the brain associated with exposure to dubious study methodology. Here Randall makes fun of the overly confident, sweeping statements made by some fMRI researchers, often in the press. Of course, fMRI technique requires that the researcher account for several possible sources of errors by, among others, performing proper statistical analyses, multiple comparisons and using proper control groups. These are usually the reasons for fMRI criticism. See the link for further information, including a famous ironic study of a dead salmon which was shown various pictures of people while fMRI scans were made. The scans could be interpreted as showing meaningful brain activity, unless the multiple comparisons problem was properly addressed. Randall has previously made fun of geographic profiles falling to this trap in comic 1138.

The title text then continues with the jewelry issue, now especially the concern about unremoved piercings. In the worst case these could be ripped off by the strong magnetic field. So it could be of some concern - especially when you take into consideration some of the places people may have piercings that are not obvious to the MRI personnel! The final remark about activation

regards exasperation with fMRI techs who won't stop talking about Warped Tour. "Warped Tour" refers to a traveling music festival that has been going since 1995, originally as a punk rock festival, but now with a more diverse set of music. Due to the nature of Mosh Pits, the loud, cacophonous music, the facial jewelry of concert-goers and the tight quarters of the pit make it similar in description to an MRI.

## #1454: Done

December 01, 2014



I'm sorry, but the author of this Facebook comment clearly believes you were.

## Explanation

This comic is a joke about the hyperbolic expression shut it down being taken literally. If someone thinks that a device has achieved its goal they shut it down. After an idea or product that people think is well made is created people will joke that the process that created it should be shut down, as if the process has achieved its ultimate purpose. This is most often used sarcastically for an inferior product or idea. Taking things literally is a common theme in the xkcd comics.

Curly-hair sits at a computer anxiously and nervously writing a message to someone they care about deeply, possibly a child to be adopted or a romantic interest. Curly-hair plans on saving enough money to have the person flown to their location from "half a world away." Curly-hair ends the message with a promise to communicate daily until the two are able to meet. When attempting to send the message, however, Curly-hair discovers that their internet connection is down and the message goes unsent.

Ponytail explains there was a "ridiculous video" to which someone had commented "That's it. Shut down the Internet. We're done." This was taken literally and, because enough people agreed with this comment, the internet was shut down and Curly-hair was left unable to communicate with their love.

The joke being that the internet was creating something

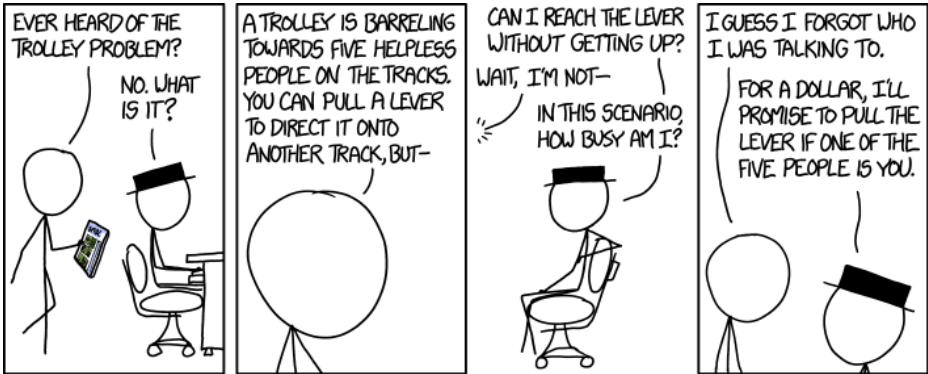
far more valuable between Curly-hair and their love than a ridiculous video, thus highlighting the beautiful and far reaching potential impact of the internet. The likelihood of the entire internet being shut down based on a single comment being vanishingly low adds to the humor.

In the final panel Curly-hair states wistfully that they were not done with the internet. The title text is Ponytail's response, which asserts Ponytail's belief that Curly-hair's message could not be important because the Facebook comment asserted that nothing of any significance could come from the internet after the ridiculous video.



## #1455: Trolley Problem

December 03, 2014



For \$5 I promise not to orchestrate this situation, and for \$25 I promise not to take further advantage of this ability to create incentives.

## Explanation

The trolley problem is a thought experiment often posed in philosophy to explore moral questions, with applications in cognitive science and neuroethics. The general version is that an out of control trolley (or train) is heading towards 5 people on the track who can't get out of the way. On an alternative branch of the track is 1 person who can't get out of the way. The trolley can be diverted by using a lever, with the consequence of saving the 5 people but killing the 1 person.

The choice is between a deliberate action that will directly kill one person, or allowing events to unfold naturally, resulting in five deaths. The question posed is whether or not it is morally right to pull the lever. The moral question is not as simple as it may first appear.

This results of this test report that around 86% of respondents choose the utilitarian option of diverting the trolley.

There are, however, several alternative formulations of the same basic dilemma. One such scenario allows you to stop the trolley by deliberately pushing "a very fat man" into its path, killing the man but saving the other five people. Another scenario involves selecting a healthy young and innocent person to die, in order to save five others going through organ donation. In both of these examples the basic dilemma is the same. However, most people reject the utilitarian option in these cases.

After discovering a variation on this problem posed in a strip of the Saturday Morning Breakfast Cereal webcomic (which can be seen on the tablet he is carrying), Cueball, Black Hat's roommate, presents it to Black Hat. Before Cueball can finish explaining the problem, most notably leaving out the disadvantage to flipping the lever where it would kill one person, Black Hat questions whether he would need to get up to reach the lever and how much it would interrupt his other activities. As usual, he cares nothing at all about what happens to other people. This response is linked to another theory in philosophy, that of self interest or egoism or Objectivism, in which a person will choose the action with the most benefit for them personally.

Black Hat then poses an offer: he promises to divert the trolley if Cueball is one of the five endangered people, provided that Cueball pays him \$1 now. Again Black Hat is twisting the situation to his own benefit, in this case monetary. In the case of self-interest, the \$1 could be the price at which Black Hat values his time and effort, below which he feels there is no benefit to himself in pulling the lever. Cueball decides that there is no point posing the problem to someone like Black Hat and gives up. This further shows that it is challenging for people with different ethical frameworks to function together without a common understanding, either mutually or with one side using that understanding to motivate a mutually agreeable or horrible solution.

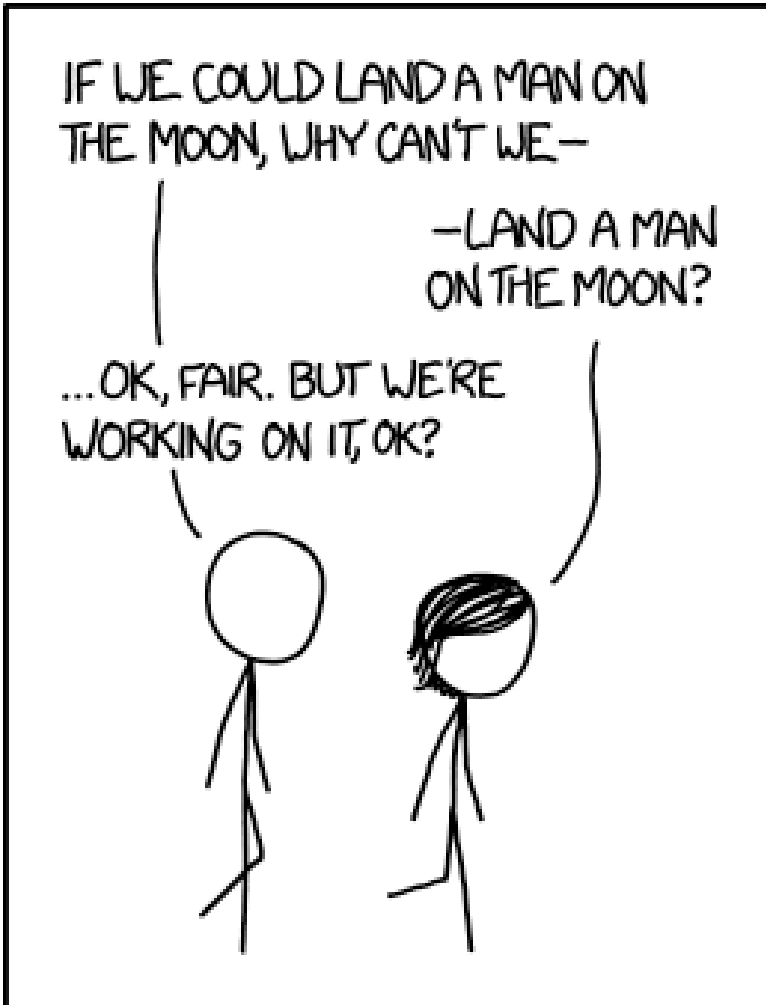
The title text follows this up by continuing Black Hat's offers. For \$5 he will not deliberately arrange this

situation and for \$25 he will quit looking for further incentives. These attempts to exploit the thought exercise for personal gain further demonstrate Black Hat's cynical amorality.

Black Hat's offer makes Cueball himself the subject of the trolley problem: Cueball now has a choice of expending \$1 to save 5 people (including himself) while sacrificing one person, or \$5 to save all 6 people. Of course, he could dismiss the offer as a joke, if not for the fact that the person making it, which, as we know from other comics, is very much capable of such exploits.

## #1456: On the Moon

December 05, 2014



"I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on Venus and returning him safely to—" [an aide frantically whispers in the president's ear for a moment]

"... of landing a man on Venus."

## **Explanation**

Explanation section not found.

## #1457: Feedback

December 08, 2014



THE ERRATIC FEEDBACK FROM  
A RANDOMLY-VARYING WIRELESS  
SIGNAL CAN MAKE YOU CRAZY.

A new study finds that if you give rats a cell phone and a lever they can push to improve the signal, the rats will chew on the cell phone until it breaks and your research supervisors will start to ask some questions about your



grant money.

## Explanation

This comic is a joke about the psychological theory that animals conditioned using seemingly random rewards and punishments promotes superstitious behavior, and then extrapolates this theory to humans and Wi-Fi or (more likely) Cellular signal integrity.

Often when connecting to unfamiliar Wi-Fi networks or when in a poorly covered area of a cell network, the signal displayed by the connecting device varies wildly, especially as distance increases. Poor wireless signal and drops in connection can be extremely frustrating, and hence Cueball has likely tried a variety of methods to improve the signal. As a result of his desperation, he replicates scenarios that are unlikely methods to increase his signal, but in some way mirror conditions where he has been successful finding a signal in the past. His past conditions have somehow led him to having the superstition that holding a pineapple while standing on top of a chair may resolve the problem. Likely, the signal increased at random while he was standing on a chair holding the pineapple, and he erroneously concluded that the chair and pineapple caused the signal strength increase. It is almost inconceivable that this technique could have any positive effect on the signal. This is related to the idea in comic 552: Correlation. See also the much later 2259: Networking Problems.

Megan questions his ridiculous behavior, but it seems Cueball has become extremely erratic due to the

inconsistent signal strength.

The title text refers to a fictive study that apparently examined the behavior of rats in response to signal strength on a cellphone. It is a reference to B. F. Skinner's experiments. In these experiments, rats and, more frequently cited, pigeons are taught superstitious behavior by being rewarded at random intervals. In this new experiment the rats naturally could not understand the concept of signal strength,[citation needed] so they chewed up the cellphone till they broke, leading to the research supervisors questioning the validity of the study and questioning whether the grant money for the study was well used.

### **Skinner's real experiment[edit]**

Skinner placed a series of hungry pigeons in a cage attached to an automatic mechanism that delivered food to the pigeon "at regular intervals with no reference whatsoever to the bird's behavior." He discovered that the pigeons associated the delivery of the food with whatever chance actions they had been performing as it was delivered, and that they subsequently continued to perform these same actions.

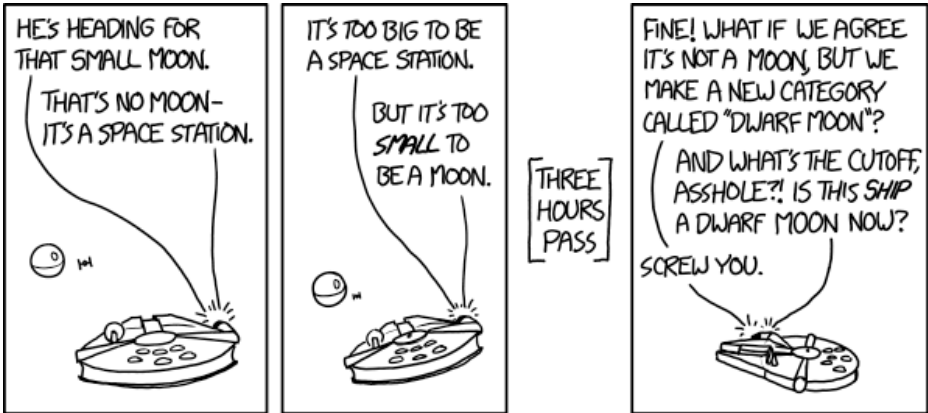
One bird was conditioned to turn counter-clockwise about the cage, making two or three turns between reinforcements. Another repeatedly thrust its head into one of the upper corners of the cage. A third developed a 'tossing' response, as if placing its head beneath an invisible bar and lifting it repeatedly. Two birds developed a pendulum motion of the head and body, in which the head was extended forward and swung from right to left with a

sharp movement followed by a somewhat slower return. Skinner suggested that the pigeons behaved as if they were influencing the automatic mechanism with their "rituals" and that this experiment shed light on human behavior.

See this Mind Field episode where this experiment has been performed on humans!

## #1458: Small Moon

December 10, 2014



**GENERAL JAN DODONNA:** An analysis of the plans provided by Princess Leia has reinvigorated the arguments of the 'artificial moonlet' and 'rogue planet-station' camps. I fear this question is fracturing the Rebellion.

## Explanation

The comic depicts a classic scene from Star Wars Episode IV, in which the heroes trail a TIE fighter to the never-before-seen Death Star: a super-weapon the size of a small moon capable of demolishing entire planets. In the original scene and the comic, Luke Skywalker misidentifies a body as a natural satellite, and Obi-Wan 'Ben' Kenobi ominously corrects him.

The comic's version diverges at this point, as the dialogue devolves into a rather bitter argument over the semantics of size classifications, alluding to scientific discussions on whether Pluto should be classified as a planet or as a dwarf planet. The argument goes on for hours, which in the original plot would suggest one of two situations:

- The Death Star apparently never caught them, and Princess Leia was never rescued (but Ben survived); this take is supported by the official transcript.
- The argument was picked up after escaping the Death Star, and now Leia is joining in.

The argument is confused as to whether they're talking about size or about natural vs artificial objects. In terms of size, the Death Star is much larger (70 km radius) than dozens of full-fledged moons in our solar system. One of the smallest moons found so far in the solar system is S/2009 S 1, which is about 400 meters in diameter and orbits Saturn. But we don't generally speak of the tiny rocks in the rings of Saturn as moons, so there is some

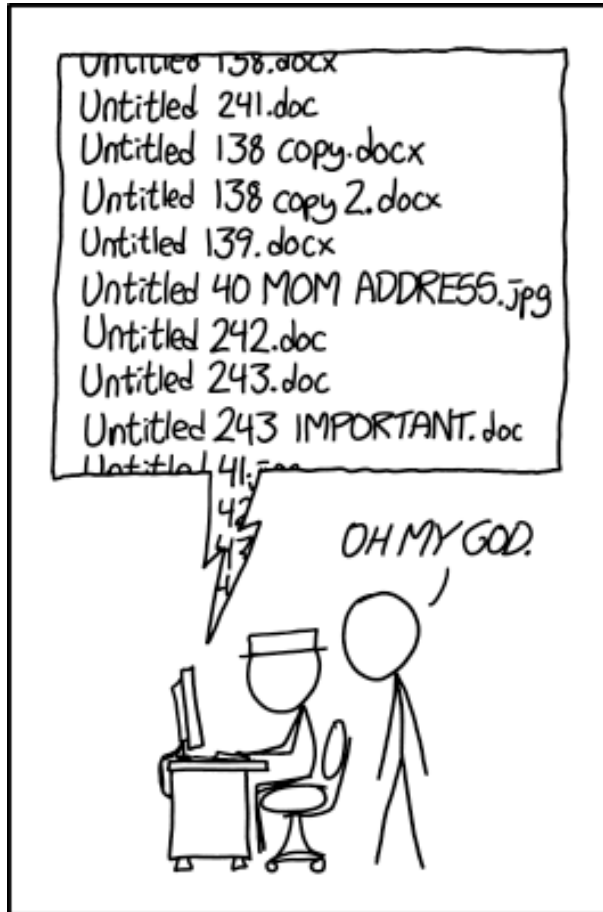
distinction there, which may include the orbit of the object . There is also the distinction between natural moons and spacecraft, which seems to be ignored in the final panel.

The title text makes reference to a later scene in the film when Rebel pilots are being briefed on the planned attack on the Death Star. Those who analysed the plans for the Death Star run into the same discussion picture, and end up arguing about the classification of the Death Star, dividing those involved into the "artificial moonlet" camp and the "rogue planet-station" camp, thus deunifying the rebellion. If events are otherwise the same from the movie, this is also happening at threat of their destruction, and thus a crippling of the Rebellion.

The timing of the comic may be related to the New Horizons mission to Pluto. The spacecraft awoke from hibernation 4 days earlier, on December 6, 2014, to start the encounter phase with Pluto.

## #1459: Documents

December 12, 2014



PROTIP: NEVER LOOK IN SOMEONE  
ELSE'S DOCUMENTS FOLDER.

Copy of Copy of Copy of Copy of Copy of Copy of Copy of  
Copy of Copy of Copy of Copy of Copy of Copy of Copy of  
Copy of Copy of Copy of Copy of Copy of Copy of Copy of  
Copy of Copy of Copy of Copy of Copy of Copy of Copy of



Copy of Copy of Copy of Copy of Copy of Untitled.doc

## Explanation

When saving documents, the user is typically prompted to choose a filename, which may seem like a trivial choice. However, the filename is often the primary way of identifying the document you are looking for, and a descriptive title is of huge benefit when trying to find a certain document. Those who are too rushed or too lazy to create a useful filename, or those who don't understand what constitutes a useful filename are setting themselves up for future frustration.

When a user creates a new copy of a file in the same directory, the operating system may automatically append "copy" or "Copy of" to the filename. Subsequent copies of the file have "copy 2", "copy 3", etc. appended. When searching documents later, the user may struggle to remember which copy is the correct one to use.

This comic portrays a person, in this case White Hat, who has taken such a naming convention to an extreme, giving hundreds of documents essentially the same confusing or useless filename. Cueball appears to have a severe distaste for this convention (or may just be in shock at how one could be so lazy or incompetent in the short term to suffer through or ignore the consequences in the long term) and hence provides a protip to never look in someone else's documents folder for the fear of finding these irritating details.

The .doc and .docx extensions are given to documents

created in Microsoft Word, with .docx being the default option from Microsoft Office 2007 onwards. When first saving a document, many programs will default to "Untitled", adding numbers to the end as more are created. However, in Microsoft Word the default filename is the first sentence of the document; if the document is still empty, the default filename is "Doc1" with the number increasing each time. In order to get such a file directory, White Hat would either have to manually title all of his documents "Untitled", or use another app that can use the .docx extension and defaults its filenames to "Untitled", like google docs. He appears to frequently make copies, and occasionally made copies of the copies, only very rarely adding a keyword to the file name like "important".

In some cases he has added a minimal amount of detail to the filename, though hasn't removed the redundant "untitled copy" portion, which probably only adds to Cueball's frustration, as it demonstrates that White Hat does have at least a basic understanding of the importance of meaningful filenames, but still hasn't made any attempt to address the systemic problem.

The Untitled 40 MOM ADDRESS.jpg is an image file (jpg), not something that would normally be used to store someone's address, though it could be a map or a picture of an envelope. It is the first jpg file on the list, but that last full filename is also a jpg with number 41, and below in the "speech" line down to the PC the next three files have number 42, 43 and something beginning with 4. So here the numbering of jpg files continue.

The .doc numbering goes from 241 to 243, and then 243 IMPORTANT. The .docx only increases from 138 to 139, but there are two extra copies of the 138 document.

The filenames are not in alphabetical order as 241 and 40 falls out of place. This likely means that there is no automatic sorting all (i.e., they are sorted by hand), or that they are sorted by time stamp. Sorting by timestamp can be very useful, especially if you use White Hat's naming scheme. But this also means that he still uses .doc (copies old files) after he has obtained the new Microsoft Office 2007 that used .docx.

The title text can refer to one of two common quirks in Windows/Office. One is of copying and pasting within the same folder on a Windows PC. The copy of the file will default to the name "Copy of <original title>", a second copy becomes "Copy of Copy of <original title>" and so forth. The other common quirk that can produce file names like this relates to how Microsoft Office handles downloaded file(s) that are not saved (i.e. "Open" instead of "Save"), the file is actually saved in a temporary folder allowing you to look at and/or edit the file - usually with restrictions on doing so until you actually save a copy in an actual folder somewhere. Oftentimes, especially within an office network where files are passed around via email, the other person may just open a file, editing it, then proceeding to save it as required. Upon attempting to save, the program will prompt one to "Save a copy of the original file", as the original file was never actually saved on the hard drive but just opened from a temporary folder, adding the phrase "Copy of" to the

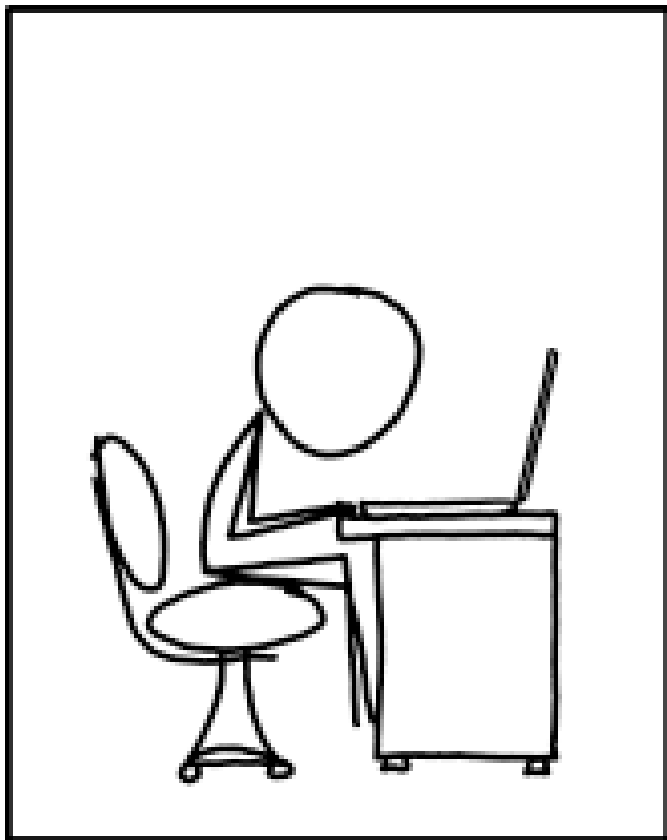
filename, regardless of its final location. Forwarding this file will continue this trend adding the phrase "Copy of" every time someone opens, edits then saves the file (rather than save the file then edit it), thus creating repetitive use of "Copy of" within the same name. In a file that is heavily edited and passed around via email like this, if care is not taken to edit the file name, the name may get up to 5 or 6 repeats of the phrase "Copy of".

It is rather extreme to get to a 33rd copy of the original untitled.doc file as shown here, however, as a result the file name is 276 characters long (including the four from the .doc extension), an impossible file name in most operating environments because it is too long. 255 characters is the limit for any file or folder name in Linux, and is the limit for a fully defined file name (file name, extension and the full folder path in which the file is stored in) in Windows. So the file name is 22 characters too long for Linux and at least 25 characters too long for Windows since being in the root of drive takes 3 characters, each folder adds at least 2 characters (one chosen and the backslash). Whereas such long names for a file may be uncommon, it is not uncommon in Windows that users run out of characters for the full name and path, if they have several sub folders.

Note that when performing this type of copying on Windows 7, the new file is named "<original name>\_2", not "Copy of <original name>".

## #1460: SMFW

*December 15, 2014*



SMFW AN ACRONYM  
ALMOST MAKES SENSE

wtfw it's like smho tbfh, imdb.

## Explanation

Randall gives some examples of confusing initialisms (technically not acronyms) that closely resemble more commonly-used initialisms. He depicts Cueball apparently puzzling over the meaning of one such initialism.

"SMFW", the title of the comic and an initialism used as the caption, is very close to a number of other common initialisms, including:

- "MFW", meaning "my face when..." used in similar sentence constructions to this comic's caption, to indicate that the image represents one's face when the specified thing happens.
- "SFW", meaning "safe/suitable for work", denoting that something does not have suggestive content.
- "SMH", meaning "shaking my head" or "so much hate", used to indicate dismay.
- "SMF", meaning "so much fun".
- "NSFW", meaning "not safe for work", the opposite of "SFW".

The title text contains more examples of imaginary initialisms of a similar nature:

- "WTFW" is a combination of "WTF" ("What the fuck") and "TFW" ("That feel when..." or "That face when...", used in a similar nature to "MFW"), and possibly

"FTW" ("For The Win") and "FWIW" ("For What It's Worth").

- "SMHO" is a combination of "SMH" ("shake my head") and "IMHO" ("In my humble/honest opinion...").
- "TBFH" is a combination of "TBF" ("to be fair") and "TBH" ("to be honest").
- "IMDB" is, of course, the Internet Movie Database, but also resembles "IMHO".

Below are possible examples of potential (already existing, albeit rare) representations for each initialism, according to the Urban Dictionary:

- SMFW is listed as an initialism for "Smoke more fucking weed".
- WTFW is listed as an initialism for "What the fuck, what?".
- SMHO is listed as an initialism for "Shaking my head off".
- TBFH is listed as an initialism for "To be fucking honest".

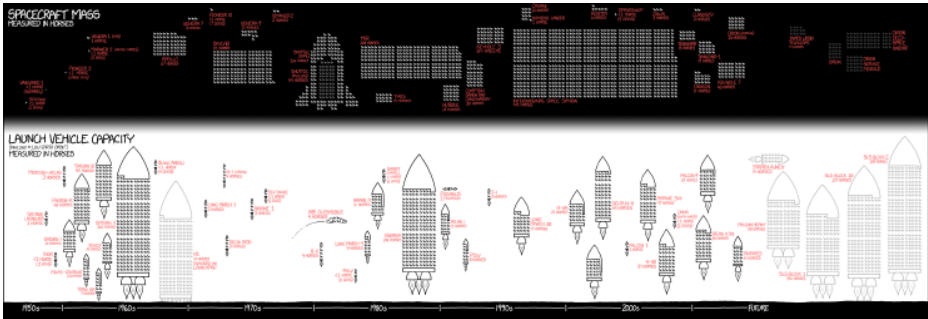
Knowing Randall, the sentences given in the comic proper and title text were probably made without an actual meaning in mind. Nevertheless, the sentence in the comic has a very plausible interpretation: "So Much Frustration When an acronym almost makes sense." Other plausible interpretations of the initialism could be "So Much Fun When" or "See My Face When". Even the absurdly cryptic title text has a plausible translation:



"What The Fuck, World? (WTFW) it's like Some Moron's Horrible Opinion (SMHO) To Be Fucking Honest (TBFH), I'm Done, Bye. (IMDB)".

## #1461: Payloads

December 17, 2014



With a space elevator, a backyard full of solar panels could launch about **500** horses per year, and a large power plant could launch **10** horses per minute.

## Explanation

This comic is an infographic representing the launch mass of various spacecraft and artificial satellites, and the low Earth orbit payload capacity of various space launch vehicles. Rather than using standard units of mass such as kilograms or pounds, Randall has assigned values based on the mass of a horse. Based on cross checking researched masses and payloads with the number of horses depicted, it appears that one horse unit is defined as 450 kg (with an average of 432.82 kg), or perhaps 1000 lb. In cases where the mass is less than one horse, an alternative measure of dogs has been used, where one dog appears to be roughly 40 kg (with an average of 48.05 kg, or perhaps 100 lb.). In the case of Vanguard 1, even a dog is too large a measure, so instead the unit squirrel is used to represent its 1.47 kg (3.5 lb.?) mass.

The overall comic may be an allusion to horsepower, a similar-sounding but completely different concept. Horsepower is a measurement of power (work per unit time). Another commonly referenced unit for power is the watt. 1 horsepower is meant to be approximately the amount of power a horse can deliver. In contrast, Randall uses the horse to measure mass (of particular spacecraft, and of the maximum payload launch vehicles can carry).

The top pane of the comic (black background) shows the mass of various spacecraft, while the bottom (white background) shows the payload capacity (to low Earth

orbit) of launch vehicles. Along the bottom of the image is a timeline, relating to the launch date of the entries.

There are also several joke insertions:

- T-Rex - A dinosaur, but fairly unlikely to be found orbiting Earth.[citation needed]
- Pegasus - An actual launch vehicle, but also the name of a mythical flying stallion. The payload is given as "one Pegasus", which comes out to be slightly less than "one horse".
- Atlas-Centaur - Again, an actual launch vehicle, but also a reference to the half-human half-horse creatures of Greek mythology. The payload is given in "centaurs", which come out to be slightly more than "horses".
- 1981 Oldsmobile - Not a launch vehicle, but in fact a car. The payload is given as 4 horses, which may relate to the carrying capacity (by weight) of the Oldsmobile, not the ability of an Oldsmobile to launch that payload into low Earth orbit. While there are no known examples of an Oldsmobile reaching low Earth orbit, The Blues Brothers movie shows an Oldsmobile performing a very, very long flight, and this might be the reason why Randall chose this specific car.

The Pegasus, 1981 Oldsmobile, and Stratolaunch spacecraft are depicted horizontally, because these vehicles launch from a horizontal starting position and use forward momentum to facilitate their launch.

An unlabelled launch vehicle is shown below the H-IIA

near 2002. From the payload and date it is believed to represent the Delta IV M. Whether its lack of labelling is intended or a mistake is unknown.

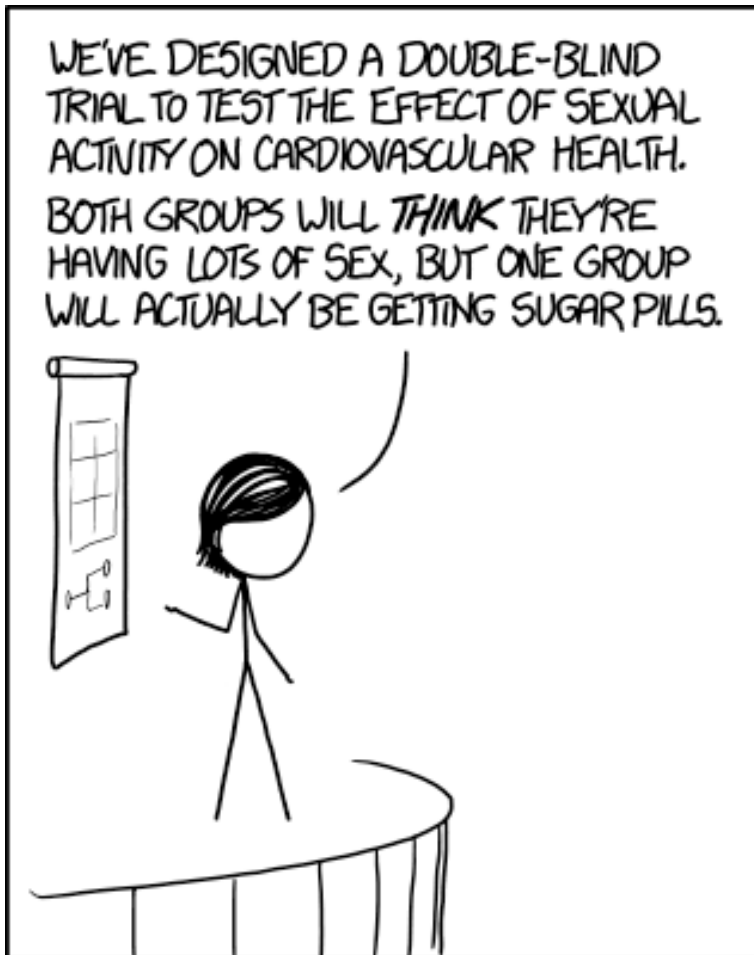
The title text refers to a favourite subject of Randall's - The space elevator. A space elevator is a (currently theoretical) mechanism for travelling into space, consisting of a very long (>35,000 km) cable and counterweight connected to the Earth at the equator. The cable rotates at the same rate as the earth, and thus appears stationary when viewed from earth. It is then possible to climb the cable into space, and even use it as a slingshot to launch vehicles.

In the title text, the amount of power required to lift a horse into space has been investigated, with the launch capacity of a backyard solar array and large power station compared. The orbit to launch the horses into is not specified, though; from the space elevator, the only circular orbit easily achievable is geostationary orbit, and getting into Low Earth Orbit is only slightly easier than without the elevator. Assuming the lowest stable orbit (that is, above the atmosphere), required power output of the solar array is about 315-350 kW and the power station at 3.3-3.7 GW.

**Tables[edit]**

## #1462: Blind Trials

December 19, 2014



### THE LIMITATIONS OF BLIND TRIALS

Plus, you have to control for the fact that some people are into being blindfolded.

## Explanation

In research, a blind trial is an experiment where certain information about the test is concealed from the subjects and/or the testers, in order to reduce sources of bias in the results. A double-blind trial is one where neither the subject nor the testers know who has or has not received treatment (or for multiple treatments, which treatment).

A scientific approach also requires the use of control groups to determine the significance of observations in (clinical) trials. The members of the control group receive either no treatment or the "standard" treatment. However, to ensure "blindness" in the study, even if a control group is to receive no treatment, they must be given a placebo: an ineffective treatment given to ensure the doctors and/or patients are unaware whether they are being given the treatment.

For example, in clinical drug trials, when a treatment being tested is administered in the form of a pill, a visually-identical inert pill is given to the control group so no one will know if a subject has been given the treatment or a placebo. In pop culture, placebos in pill-form are often made of sugar, which has negligible medical effects.

Controls and blinding are crucial to distinguish the actual effects of the treatment from the placebo effect, or the psychologically-induced effects of a subject's belief that a treatment will or will not help them, which may

have real physiologic effects or influence the reporting of subjective measures such as pain level or the presence of side effects. It is vital that there are no clues available to distinguish between the different groups. Even subtle cues from the body language of the testers are sufficient to trigger placebo effect, making double-blind trials necessary.

Challenges exist in designing placebo alternatives to certain physical treatments that might be tested, such as acupuncture; in this case the best quality trials have typically used either special 'joke' retractable needles that only give the illusion of proper penetration or the practitioner/researcher deliberately and safely avoids the traditional meridians on the body for the treatment concerned so that the patient remains 'blind' to their role in the trial. The practitioner must otherwise be consistent in treatment between groups and not be involved in the medical assessment phase for properly double-blinded conditions, where the most reliable results still seem to only show a significant placebo effect at work.

There are, however, certain cases where it is almost impossible to make the experience of the control group identical to that of the test group. Making a real and fake pill appear the same is a relatively trivial task, and the ignorance of participants to the details of a given established practice or procedure can allow for a certain level of blinding. However, it would be challenging (to say the least) to make the control group in the described experiment think that they are having lots of sex,[citation



needed] when in fact they are not. The description of the control group as taking sugar pills is a laughably poor placebo substitute, as the sensations of ingesting a pill and of engaging in sexual activity are wildly different.[citation needed]

Scientific research involving humans is extremely challenging to conduct because of the difficulty in finding appropriate control groups. This is one of the reasons animal experiments (for instance involving inbred strains of mice) are so common.

The title text adds another twist by taking “blind” literally, and noting that for some people, being blindfolded increases their enjoyment of sexual activity, thereby acting as a confounding variable.

Despite this, it should be noted that Cardiovascular health is typically measured in terms of objective data such as cholesterol levels, ejection fraction, and morbidity/mortality data like the frequency of myocardial infarctions, strokes, or sudden cardiac death. Even sighted, it would be difficult for either subjects or researchers to manipulate this kind of data.

## #1463: Altitude

December 22, 2014

BECAUSE OF LOW OXYGEN,  
ASTRONOMERS WORKING AT  
HIGH ALTITUDE TELESCOPES  
MAY NEED TO WRITE DOWN  
THEIR PLANS AHEAD OF  
TIME WHILE AT SEA LEVEL.

OK, LET'S HEAD UP  
TO THE OBSERVATORY.



WHEN WE REACH THE  
SUMMIT, WE'LL CHECK THE  
IODINE CELL AND DO A  
GENERAL CALIBRATION.

SOUNDS GOOD.



MY HEAD FEELS FUNNY.

LOOK AT THOSE  
TELESCOPE DOMES.  
I HOPE THEY DON'T  
ROLL AWAY.

MAYBE WE SHOULD  
TAPE THEM DOWN.



HAHA, LOOK AT THIS MIRROR!  
MY FACE IS HUGE!

I SEE YOUR FACE  
IN THE TELESCOPE!  
I DISCOVERED YOU!

LET'S MAKE OUT!



"TURN OFF THE LASER GUIDE STAR" "WHY" "STAR CATS"

## Explanation

In this comic, Randall is making fun of how oxygen deprivation can lead to reduced mental acuity. Dizziness, lightheadedness, impaired judgment, and euphoria are symptoms of oxygen deprivation, or hypoxia. Those researchers would benefit from having a written list or plan developed while they were still functioning at peak mental acuity.

Note that high altitude does not lead to severe effects as described in the comic.

Here, two astronomers are heading up a mountain, towards the observatory they work at. Initially, they discuss what they are planning on doing once they reach the summit, mentioning Iodine cells, used for wavelength calibrations of high-resolution RV spectra between 501 and 610 nm. As they continue, the mental clarity of the researchers devolves as they approach the high altitude telescope, leading to increasingly juvenile and almost intoxicated behavior. One researcher mentioned her head feels funny, while the other makes a remark about taping down the observatories to prevent them from rolling away, an absurd remark considering observatories are firmly rooted and even if they weren't, it would take an excessive amount of tape to stop them from rolling away.

Once inside the observatory, they have completely forgotten about their original plans. Instead of doing a general calibration, they are playing with the telescopes,

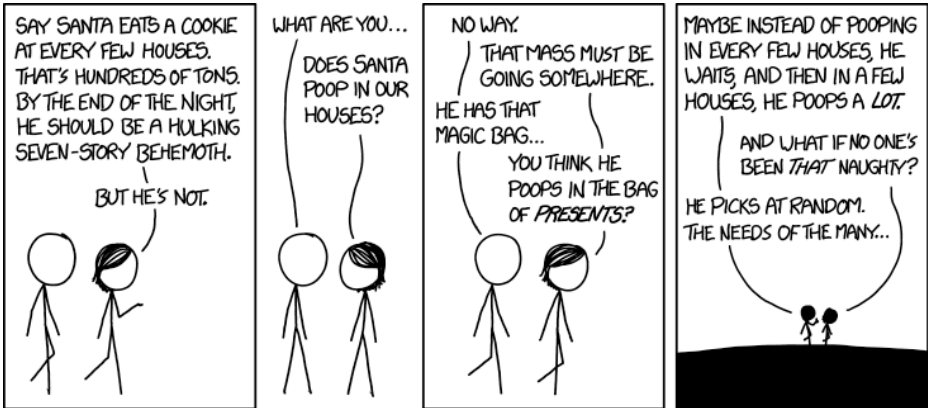
looking at each other's faces through them and deciding to make out with each other. This is why Randall mentions that astronomers working at high altitude observatories must write down their plans ahead of time at sea level, as the low oxygen leads to reduced mental acuity.

It should be noted that the phrase "low oxygen" would usually refer to the lower partial pressure of oxygen at altitude. The proportion of oxygen at high elevations is still approximately a fifth of the atmosphere, the same as at sea level, and there is not a significant stratification of gases that means oxygen (more so than the other major constituents of air) can only be found at lower altitudes, nor that they encounter a distinctively different "high (altitude) oxygen" (though something different of that kind exists even higher up, not relevant to this scenario). The altitude sickness is caused by lowered atmospheric pressure which leads to smaller amount of oxygen actually delivered ("pushed") into bloodstream.

The title text refers to a laser guide star, a device for focusing telescopes by making artificial reference points in the sky. The reference points are created by shooting a powerful laser into the sky. The concern of the astronomer in the comic is that an imagined "star cat" may be attracted to the laser in the same way that cats playfully chase laser beams projected on surfaces. Cats' reactions to laser pointers were previously explored in 729: Laser Pointer.

## #1464: Santa

December 24, 2014



He probably just poops over the side of the sleigh.

## Explanation

This was the Christmas comic for 2014 and broadly speaking, this comic follows a long list of issues raised about physical limitations Santa Claus faces, similar to other popular theoretical discussions such as the speed he has to travel and the omniscience he purportedly possesses and the mass of presents he has to carry — the story of Santa Claus was simply never designed for a world with over 7 billion people (and certainly not 8) spread through untold millions of homes. This comic combines some basic physiology with the physical law of the conservation of mass.

More specifically, this comic refers to the common tradition of leaving milk and cookies out on Christmas Eve for Santa Claus. If one assumes that Santa eats even a small percentage of the sweets left out for him, the question comes up where all the cookies go. Megan suggests that, since Santa isn't that large, he must poop them out somewhere, and wonders if he does so in our houses.

Cueball doubts that. Megan replies that mass cannot disappear completely; it has to go somewhere, to which Cueball comments that Santa has a magic bag in which he could poop. The magic bag referenced is the bag in which he carries all the Christmas presents he delivers on Christmas Eve. It is called 'magic' because a bag large enough to carry billions of presents would be much too heavy and unbalanced to carry on a sleigh pulled by only

eight (or nine) reindeer. Thus, it must be magic somehow. Megan is disgusted at the thought of Santa pooping on people's presents. An even more disgusting explanation is that the 'magic' bag might transform the poop into presents, in which case it would not need to carry many presents at a time.

Cueball proposes a third theory: that Santa only poops in a few houses, leaving large quantities in those houses. Megan says that there may not be anyone that naughty in the world, referencing the myth that Santa will leave coal instead of presents for those who misbehave. Cueball replies that it is randomly determined whose house is pooped in, burdening a smaller number of people. Specifically, Cueball quotes the beginning of Spock's aphorism from Star Trek II, "The needs of the many outweigh the needs of the few, or the one." The quote is used to justify the sacrifice people make in "allowing" Santa to poop in their homes by citing the numerous other people who are spared his feces.

The title text puts forth yet another theory: that Santa doesn't poop in houses at all, but off the side of his sleigh. This may be equally disgusting to anyone or anything unlucky enough to abruptly receive a rain of poop from the sky.[citation needed] This problem could be minimized by taking advantage of flights over water or uninhabited areas, rather than cities.

According to 1070: Words for Small Sets, a few is referring to "anywhere from 2 to 5". Currently, there are 1.9 billion children in the world, so assuming on average

that one cookie is left for Santa for each child and that Santa eats one in every 5 cookies, he consumes 380 million cookies in two 48 hour periods. Due to the convenience of time zones, approximately 48 hours from when a day starts in Kiribati until it ends in Hawaii; also, most western Christians, including Roman Catholics and Protestants, observe Christmas almost two weeks before Eastern Orthodox Christians do. According to Google, a chocolate-chip cookie contains approximately 140 kilocalories, therefore Santa consumes 53.2 billion kilocalories in the period of 2 days, or 26.6 billion kilocalories per day. As the average human daily intake is 2500 kilocalories per day, Santa has eaten 10,640,000 times the amount of daily kilocalories required by one human over the period of two days, an amount otherwise sufficient to last for over 59,111 years for a human, and producing 20 million pounds of feces. However, if we consider the dietary requirements of both Santa and the flying reindeer, and the kilocalories that reindeer would burn flying around the world carrying 1.9 billion toys, the cookies might not be sufficient. If the 1 in 5 cookies are not sufficient energy intake, Santa could probably eat every cookie left for him, which amounts to 266 billion kilocalories in the period of 2 days.

On a side note, this amount of energy is enough to power several thousand homes for a year.



## #1465: xkcd Phone 2

December 26, 2014



Washable, though only once.

## Explanation

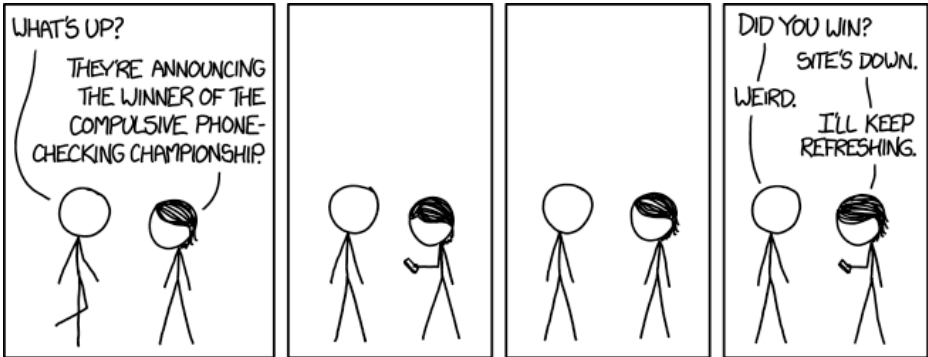
This is a followup to 1363: xkcd Phone, which debuted the original xkcd phone almost nine months prior to this one. This thus became the second entry in what turned out to become an ongoing xkcd Phone series which parodies common smartphone specs by attributing absurd or useless features to a fictional phone that sounds impressive but would actually be very impractical. The next in the series 1549: xkcd Phone 3 was released just over half a year later. Like the previous xkcd phone, the advertisement features a useless tagline (very few people can use two phones at the same time) and touts a variety of features which are either pointless, misleading, or physically impossible.

From the top, going clockwise:

The title text continues the list of features, like the previous xkcd phone comic. "Washable, though only once." means that nothing prevents the phone from physically being washed, however after the first time doing this the phone will cease to function. A play on phrases "washing machine safe" or "dishwasher safe" in real advertisements.

## #1466: Phone Checking

December 29, 2014



'Where were you when you learned you'd won?' 'I was actually asleep; I woke up when I refreshed the website and saw the news.'

## Explanation

Cueball asks Megan what's up, and Megan announces that there's a Compulsive Phone Checking Championship, presumably an award for the person who checks their phone the most often. Megan checks her phone to see if the winner has been announced, but finds the site's server is overloaded, which would be exactly what would happen if many people were checking their phones simultaneously. Given the nature of the contest, we can presume this is indeed the case. As a solution, Megan tries refreshing repeatedly, sending more load to the server and, thus, making it unavailable longer.

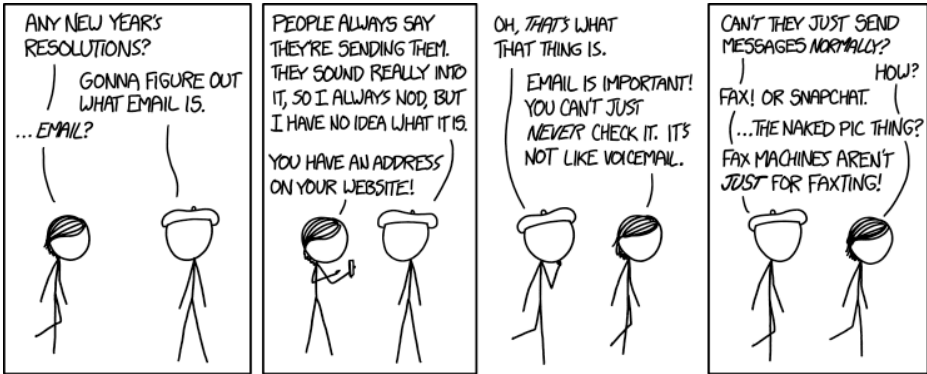
This compulsive behavior predates the popularity of mobile phones as shown in 477: Typewriter and 862: Let Go.

Another possible analysis is that the site was purposely down, and instead was the contest itself, to see how many times different users would refresh the page within a time period, or perhaps to the last one standing, determining the winner.

The title text implies that Megan checks her phone so compulsively she even does it in her sleep. This probably contributed to her victory. A "webite" is probably either a typo of "website" or a pinned tab in a web browser.

## #1467: Email

December 31, 2014



My New Year's resolution for 2014-54-12/30/14

Dec:12:1420001642 is to learn these stupid time formatting strings.

## Explanation

A New Year comic, where Megan asks Beret Guy if he has any New Year's resolutions, and even though this is just before the New Year of 2015, he resolves to find out what an email is!

Despite being in popular use since 1998 when free email providers appeared and having existed since before 1982 when SMTP was established, Beret Guy apparently doesn't understand what email is, even though he maintains a web page that includes his email address. Megan wonders how else he expects electronic messages to be sent. She explains that one must check email regularly, making a slight at voicemail, which she implies is not worth ever checking.

Beret Guy offers two alternatives: Fax and Snapchat. Megan refers to Snapchat as "the naked pic thing", calling to mind how many of its users send naked pictures of themselves over the Internet. Beret Guy replies that people use fax machines for more than just "faxing" (a made-up term similar to sexting), implying not only that many people send sexual content via fax, but also that he associates fax machines with such acts rather than Snapchat, despite faxing being a technology that predates SMTP by more than a century. Beret Guy knows what a fax is, which implies he is very behind in the technology world, so it makes sense he doesn't know what email is. But he also knows what Snapchat is, which was very popular around the time of this comic. Either Beret Guy

heard about it in a similar way to email, or he definitely knows what it is and/or uses it. What's strange is that if Beret Guy knows what Snapchat is, he should know what email is as well, since you need to provide an email account in order to create a Snapchat account.

The title text, which could be Randall's New Year's resolution for 2015, refers to various date/time formats. In programming, a point in time (e.g. the current system time) is usually stored and processed as a single number that represents the count of seconds that have elapsed since a given starting time known as "epoch" (the Unix standard epoch is January 1, 1970 at midnight, UTC). To make sense to people, this number must be converted to a human-readable format, but programmers must choose a format that best meets the needs of their users. This can be a complicated problem to solve, given that there are many different standard formats for different regions, different levels of precision for different applications, and differences between "universal time" and a user's local time zone. Randall has previously advocated for widespread adoption of the ISO 8601 format as a universal standard.

The title text also probably references a Twitter outage that took place on December 29, which was blamed on an error in a date format string.

Most programming languages provide functions to create a custom date-format string using "tokens" that represent different parts of the date/time. Here, Randall appears to have used one of these functions with the

string "%Y-%M-%D %h:%m:%s", which looks like it should produce a date and time as "Year-Month-Day Hour:Minute:Second". However, he used the wrong tokens for this:

- %Y = 4-digit year (2014)
- %M = minute (54)
- %D expands to %m/%d/%y, which is "month/day/2-digit year" in the user's local time zone rather than UTC. ("12/30/14" - see below)
- %h = abbreviated month name ("Dec")
- %m = 2-digit month (12)
- %s = Unix timestamp (1420001642 seconds since epoch)

The "%s" token shows us the actual Unix timestamp used (1420001642), which corresponds to 2014-12-31 at 04:54:02 UTC. The format string shown above thus yields "2014-54-12/30/14 Dec:12:1420001642". Note that the middle portion of this string shows "12/30" instead of "12/31" - this is due to the %D token expressing the date in Randall's local time zone (Eastern Standard Time, or EST), which is 5 hours before UTC. The time there was 23:54:02, or just before midnight, on the previous day.

The correct format string for Randall's apparent desired result is "%Y-%m-%d %H:%M:%S", which gives the string "2014-12-31 04:54:02" (UTC) or "2014-12-30 23:54:02" (EST). Given the similarity between Randall's string and



the correct one, it is easy to see how this type of formatting is confusing and often frustrating for programmers - particularly those not intimately familiar with these functions.

Randall previously addressed date/time formatting in 1179: ISO 8601 and 1340: Unique Date (the latter of which uses a formatting string correctly).

This was the second comic in a row with Megan holding a smartphone, the first being 1466: Phone Checking. The comic before that one was also about smartphones: 1465: xkcd Phone 2.

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